OFFICIAL PUBLICATION OF THE PROCEEDINGS AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS

VOLUME 44, NO. 1
JANUARY 3, 1955

# AMERICAN DYESTUFF REPORTER

Devoted to Textile Chemistry
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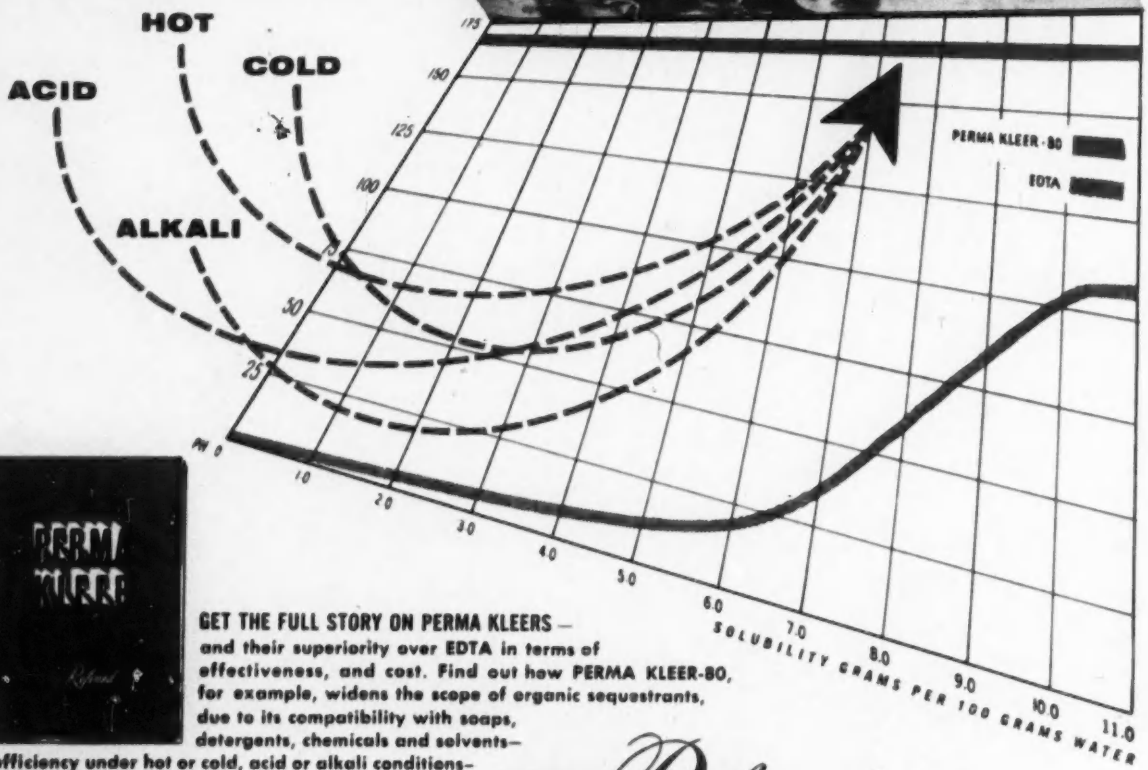


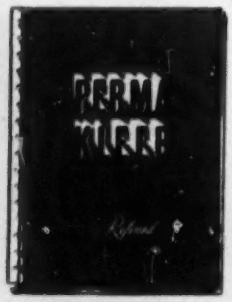


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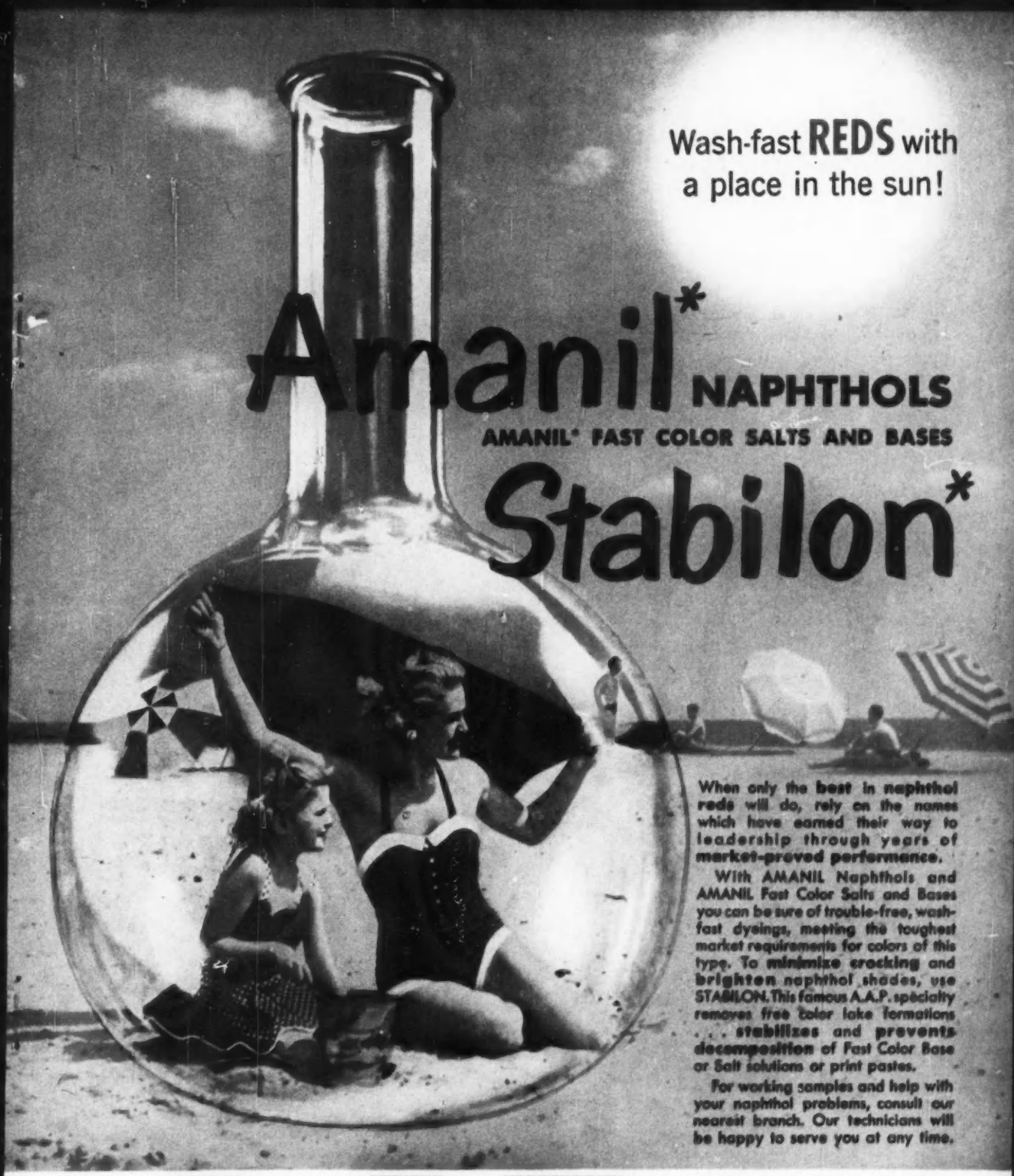

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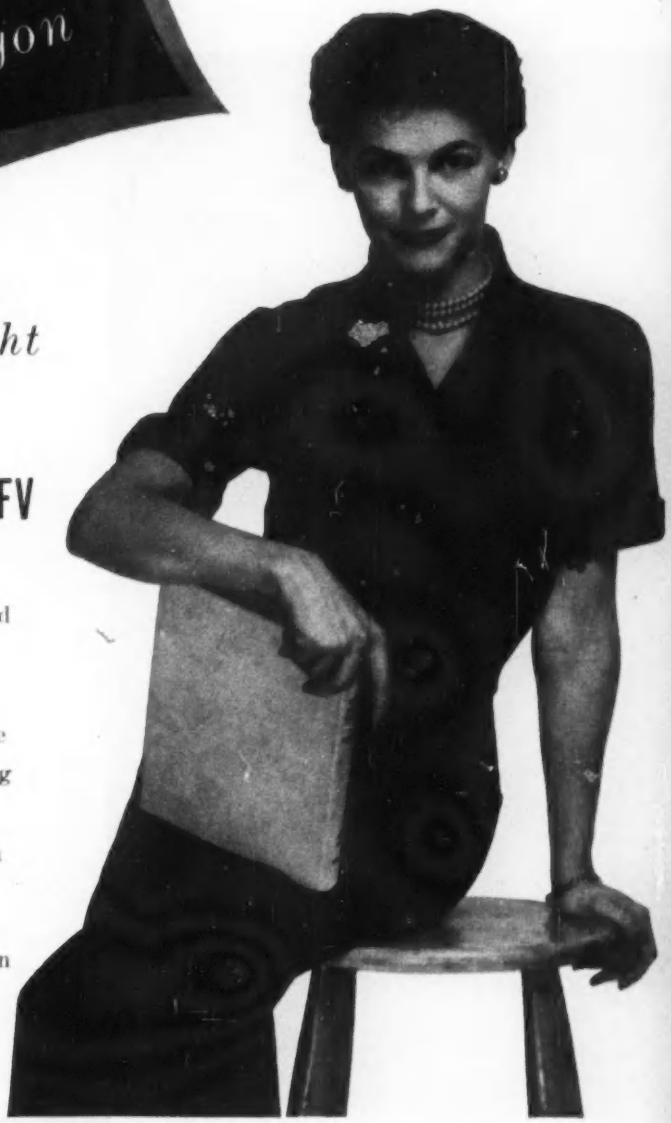

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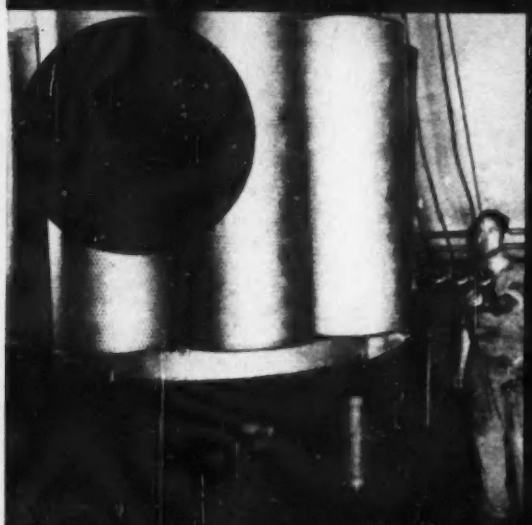

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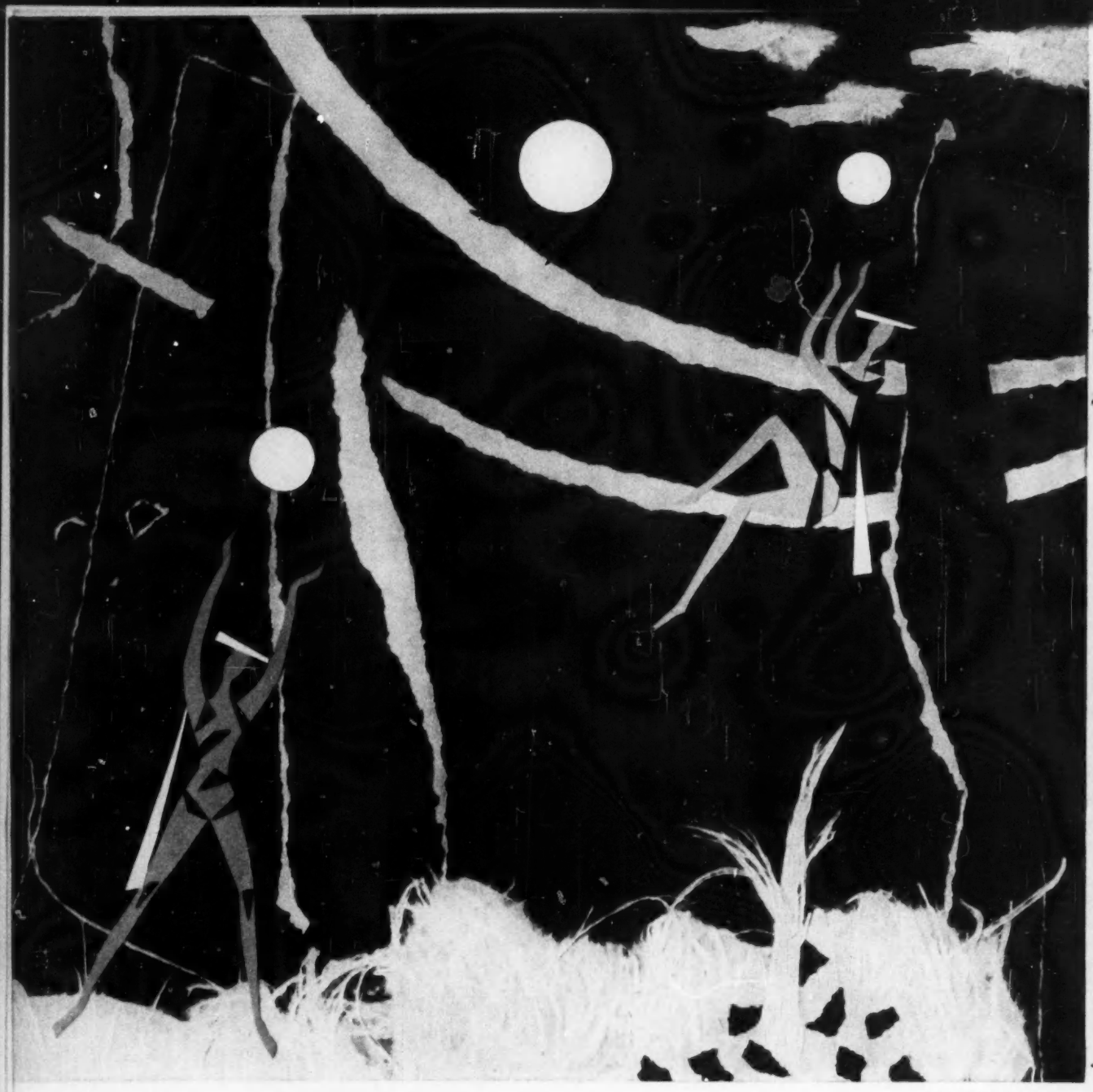

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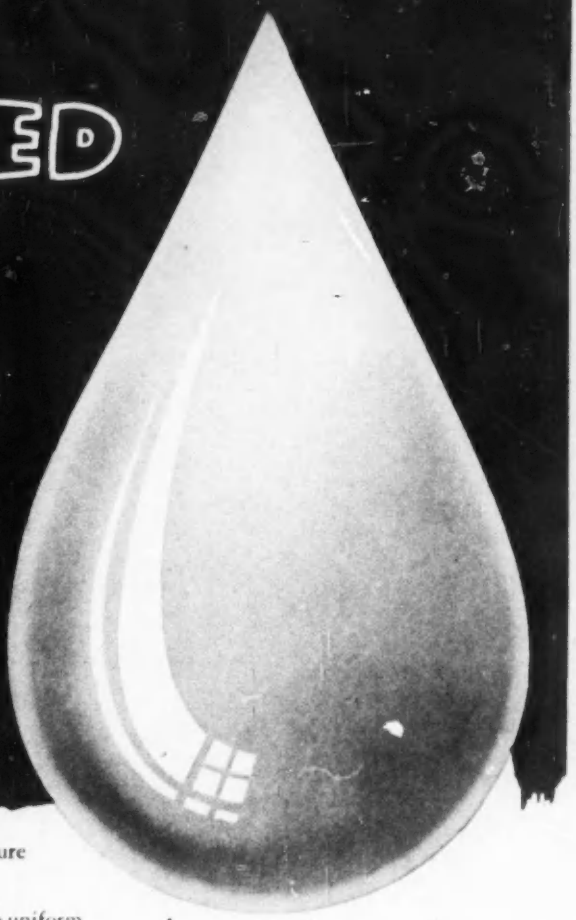

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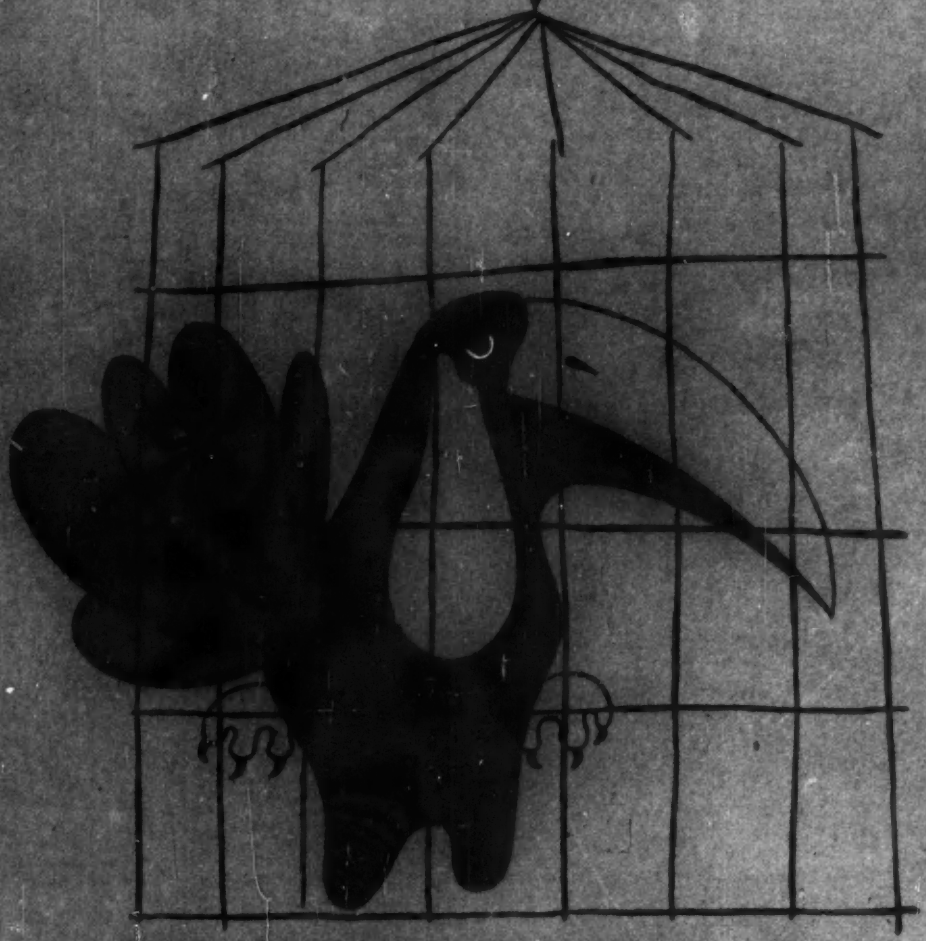

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# AMERICAN DYESTUFF REPORTER

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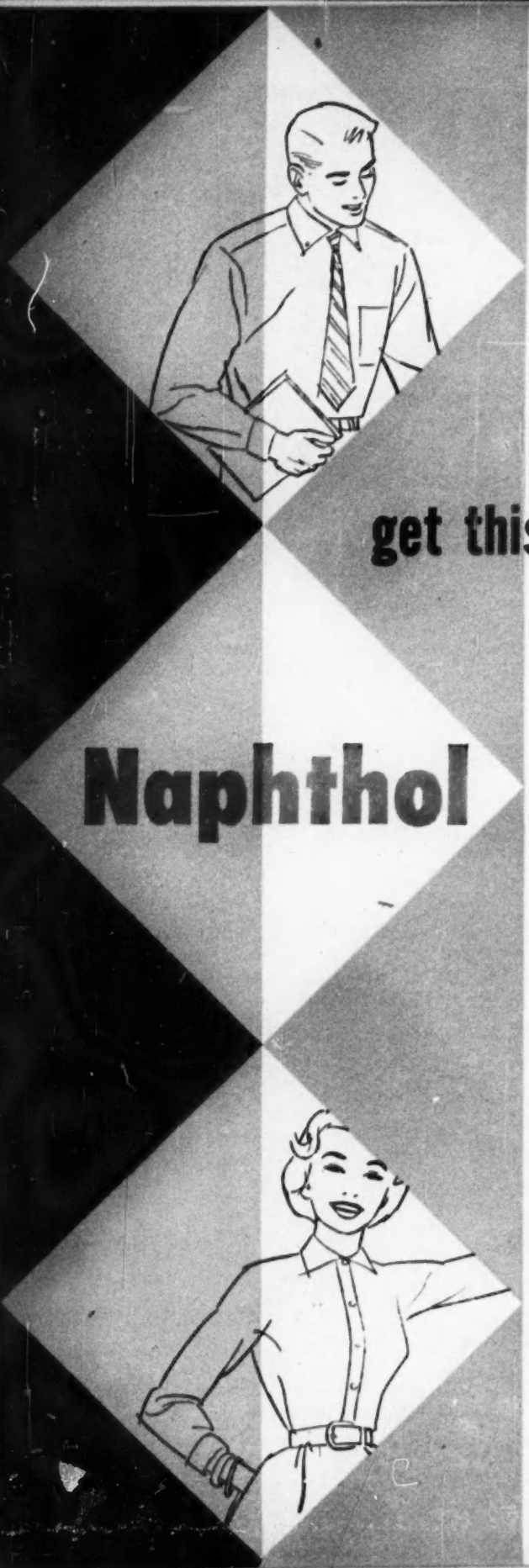

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IT is with deep humility that I accept the honor and responsibility that you have given me. Many of us were connected with this industry at a time when interchange of professional knowledge was not only frowned upon but in some instances forbidden and was a cause for discharge. We, therefore, must admire the courage and wisdom of the Founders of this Association, one of whose aims is:

"To establish for the members, channels by which the interchange of professional knowledge among them may be increased."

From an humble beginning our Association has grown in stature and service so that it has received world-wide recognition. Our Association has contributed much to the progress of the textile industry and by the establishment of test methods has provided a means for measuring that progress. Both the consumers and producers of textiles have benefited greatly from the activities of our Association.

This progress has been achieved largely by the voluntary service of many scores of members who gave unceasingly and unselfishly of their knowledge, energy and ability. To them the industry owes a debt of gratitude.

As members of the AATCC this is our heritage. May we not only honor and respect this heritage but may we continue to develop the talents which have been bequeathed to us.

R W JACOBY,
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December 17, 1954

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*Arthur R Cripps*—Development chemist, Plastic Film Corp, Plainfield, Conn. Sponsors: J R Redmond, E W Counsell.

*Carolyn B Darsey* — Chemist, Callaway Mills, Res & Dev Div, LaGrange, Ga. Sponsors: J B Tatum, W M Slaughter.

*Erling Franck*—Director, Danish Textile Research Institute, Copenhagen, Denmark.

*Jane V Gallagher* — Chemist, Research Div, U S Testing Co, Inc, Boston, Mass. Sponsors: M H Gurley, Jr, H J Wollner.

*John W Gilkey*—Research group leader, Dow Corning Corp, Midland, Mich. Sponsors: E J Eddington, K D Bacon.

*Everette W Hendrix*—Assistant dyer, Pacific Mills, Lyman, S C. Sponsors: H R Glover, J L Green.

*Manfred Joseph* — Chemist, U S Army Ordnance Corps, Picatinny Arsenal, Dover, N J.

*Ewald F Kappel*—Dyer, Narrotex Corp, Passaic, N J. Sponsors: S Levin, A A Caddell.

*Daniel L Masland*—Manager, Nice Yarn Co, Div C H Masland & Sons, Wakefield, R I. Sponsors: W Z Leaphart, K E Hankins.

*Erwin B Menhofer*—Tech dir, Augsburger Buntweberei, Bavaria, Germany. Sponsors: F Raff, M G Stern.

*John H Matheuson*—Tech rep, Carbide & Carbon Chemicals Co, Philadelphia, Pa. Sponsors: J M Jester, Jr, H B Dohner.

*Edmond Mishaan*—Plant superintendent, Textiles de Seda Miratex, Bogota, Colombia. Sponsors: I L Arthur, H Abadi.

*J Nunnikhoven*—Chemical engineer, NV Eindh Katoen MIJ, Eindhoven, Holland. Sponsors: L Fusser, G S Neisser.

*Charles J Papini*—Supt printing, Lanett Bleachery & Dye Works, Lanett, Ala. Sponsors: J L Wyman, W B Amos.

*Otto Poltersdorf*—Research chemist, Pad-Dye Corp, Paterson, N J. Sponsors: C A Whitehead, N A Johnson.

*Leonard C Shive, Jr*—Southern rep, Tanatex Corp, Kearny, N J. Sponsors: P J Scott, S M Weinstein.

*Max Wegmann*—Chief chemist, Vereinigte Farbereien & Appretur, Zurich 5, Switzerland. Sponsors: W G Helmus, H Moore.

*Theodore T Wroble* — Finishing supervisor, Waldrich Co, Delawanna, N J. Sponsors: R Van Deree, J A Komninos.

*JUNIOR*

*Donald L Campbell*—Dyer (apprentice), Bradford Dyeing Assoc, Bradford, R I. Sponsors: E J Chornyei, A Hustwit.

*Vance L Readling*—Dyer, Smith Hosiery Co, Newton, N C. Sponsors: J B Foster, Jr, R G Haislip, Jr.

*ASSOCIATE*

*Rhoderick R Blue*—New England rep, Roma Chemical Corp, Brooklyn, N Y.

*William H Byles*—Chemist, Union Bleachery, Greenville, S C.

*(Concluded on page P4)*

# AATCC CALENDAR

*(A general calendar of events may be found on page 32)*

**COUNCIL**
Jan 21 (Hotel Statler, New York). Apr 29 (Hotel Dennis, Atlantic City, N J). June 17.

**NATIONAL CONVENTIONS**
Sept 22-25, 1955 (Chalfonte-Haddon Hall, Atlantic City, N J; 1956 (Waldorf-Astoria, New York); 1957 (Boston).

**HUDSON-MOHAWK SECTION**
Jan 14, Feb 25, April 15 (Albany, N Y); May 20 (Ladies Night); June 24 (Annual Outing).

**NIAGARA FRONTIER SECTION**
Jan 14 (Buffalo); Mar 4 (Hamilton, Ont); April 22 (Buffalo); June 24 (Outing).

**NEW YORK SECTION**
January 28 (Georgian Room, Hotel Statler, New York); February 25 (Skytop, Hotel Statler, New York); March 18, April 22, May 20 (Kohler's Swiss Chalet, Rochelle Park N J).

**PHILADELPHIA SECTION**
Jan 14 (Kugler's Restaurant, Philadelphia, Pa).

**PIEDMONT SECTION**
Jan 29 (Poinsett Hotel, Greenville, S C); Apr 30 (Robert E Lee Hotel, Winston-Salem, N C); June 10-11 (Mayview Manor, Blowing Rock, N C); Oct 29 (Hotel Wm R Barringer, Charlotte, N C).

**WASHINGTON SECTION**
Feb 11 (Washington); May 20.

**WESTERN NEW ENGLAND SECTION**
Jan 28, Mar 18 (Rapp's Restaurant, Shelton, Conn); May 13 (Ladies Night); June 17 (Annual Outing); Sept 16 (Rapp's); Nov 4 (Hartford, Conn); Dec 16 (Rapp's).

## Executive Committee for '55 Convention

FREDERICK V TRAUT, chairman of the Philadelphia Section, last month called together the Executive Committee for the 1955 AATCC Convention, which will be held at the Chalfonte-Haddon Hall in Atlantic City, N J, September 22-25. The group was addressed by George O Linberg, chairman of the National Convention Committee, who pointed out the general theme of the convention and offered the assistance of the National Committee.

The Executive Committee is comprised of the following:

*Chairman*———Frederick V Traut, Globe Dye Works;

*Co-chairman* ——— Herman L Steen, Geigy Co, Inc;

*Banquet*———Francis E Nevins, Ciba Co, Inc;

*Entertainment*———John L Fancourt, W F Fancourt Co;

*Exhibits*———C T Anderson, Ciba Co, Inc;

*Ladies* ——— Matthew A Noonan, Becco Sales Corp;

*Printing & Personnel* ——— Thomas J Scanlon, T J Scanlon Co;

*Publicity* ——— Thomas R Scanlan, Jr, Hart Products Corp;

*Registration* ——— Ernest Empting, General Dyestuff Co; A E Raimo, John Campbell Co;

*Reservations*———Edward C Diehl, Ankokas Dyeing & Processing Co;

*Technical Program* ——— Arthur W Etchells, Hellwig Dyeing Corp;

*Transportation* ——— Richard A Shimp, E I duPont de Nemours & Co, Inc;

*Reception* ——— Thomas H Hart, The Hart Products Corp.

### EMPLOYMENT REGISTER

*This column is open for two insertions per year, per member, without charge. Blanks can be obtained from, and filed with, the Secretary of the Association, Post Office Box 28, Lowell, Mass. It is understood that these will be open to inspection by prospective employers who can obtain further information from the Secretary.*

54-39

*Education:* B S, textile engineering and chemistry

*Experience:* Testing, quality control; supervision of bleaching, dyeing, printing & finishing.

*Age:* 31; married; references.

12-20, 1-3

## ACTIVITIES OF THE LOCAL SECTIONS

HUDSON-MOHAWK———The Hudson-Mohawk Section met on December 2nd at Jack's Restaurant, Albany, N Y, with 35 members and guests in attendance. R J Holmes, Commercial Development Dept, General Aniline and Film Corp, presented a paper on "The Uses of Polyvinyl Pyrrolidone", with D B Witwer of the same concern assisting in the discussion.

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NIAGARA FRONTIER———A joint meeting of the Niagara Frontier Section and the Ontario Section of the Canadian Association of Textile Colourists and Chemists, held November 26th at McMaster University, Hamilton, Ontario, was attended by approximately 75 members.

N J Mohoruk, Hamilton Cotton Co, served as general chairman of an open-forum discussion with L S Thompson, General Dyestuff Co, P L Meunier, E I du Pont de Nemours & Co, Inc, and C B Musgrave, Barrymore Cloth Co, serving as chairmen of the Cotton, Synthetic Fiber and Wool Sections, respectively.

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PACIFIC NORTHWEST———40 members attended the November 12th meeting of the Pacific Northwest Section at the Multnomah Hotel, Portland, Ore, at which F G Steiner, Ciba Co (Switzerland), spoke on "World Processing Here and Abroad".

New officers for 1955 were elected as follows: *Chairman*———Robert E Newman, Jantzen Knitting Mills; *Secretary*———Theodore M Marshall, Nyanza Color & Chemical Co, Inc; *Vice Chairman*———Alex H McKenzie, Jr, Portland Woolen Mills, Inc; *Treasurer*———John L Ayres, E I duPont de Nemours & Co, Inc.

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PHILADELPHIA———Featured speaker for the December 3rd meeting of the Philadelphia Section was J F Laucius, E I du Pont de Nemours & Co, Inc, who spoke on "Dyeing of Orlon Acrylic Fiber and Blends with Other Fibers". The meeting was held at Kugler's Restaurant.

During the business session, Chairman Frederick V Traut, Globe Dye Works, asked for a report of the tellers on the results of the election of officers for 1955. William H Bertolet, III, Laurel Soap Mfg Co, Inc, chairman of the tellers, announced that the following had been elected: *Chairman*———Frederick V Traut; *Vice Chairman*———Thomas H Hart, The Hart Products Corp; *Secretary*———Thomas J Scanlon, T J Scanlon Co; *Treasurer*———Percival Theel, Philadelphia Textile Institute; *Councilors*———Carleton T Anderson, Ciba Co, Inc, Edward S Diehl, Ankokas Dyeing & Processing Co; Arthur W Etchells, Hellwig Dyeing Corp, Harry L Morgan, James Lees & Sons, and Jackson A Woodruff, American Viscose Corp. Sectional Committeemen are V T Hartquist, Jefferies Processors; Francis E Nevins, Ciba Co, Inc; Matthew A Noonan, Becco Sales Corp; and Donald W Robinson, Para-Chem, Inc.

The next regular meeting of the Philadelphia Section will be held at Kugler's on January 14 at which time R J Thomas, E I du Pont de Nemours & Co, Inc, will present the Section's 1954 Intersectional Contest Paper, "Factors Affecting Tint Removal from Staple Fiber".

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RHODE ISLAND———Approximately 200 members and guests attended the Annual Meeting of the Rhode Island Section at the Crown Hotel, Providence, R I, on December 2nd.

W George Parks, University of Rhode Island, delivered the Section's 3rd-prize-winning 1954 Intersectional Contest paper, "An Investigation of the Properties of Cyanoethylated Cotton". Another program feature was a display of slides by James Pilkington, Riveredge Printers, covering his trip through nine European countries this past summer.

The following officers were elected for 1955: *Chairman*———Arthur F McLean, Glenlyon Print Works; *Vice Chairman*———R F Caroselli, Owens Corning Fiberglas Corp; *Secretary*———Charles F Stokes, Carbic-Moss Corp; *Treasurer*———J William Timperley, Kenyon Piece Dye Works; *Councilor*———Edward H Gamble, E I duPont de Nemours & Co, Inc; *Sectional Committee*———Donald J Eccleston, Hilton-Davis Chemical Co, William J Jutras, Jr, Warwick Chemical Co, Herbert F Kilguss, Apponaug Co, and C Wendall Lever, Wanskuck Co.

*(See photos of meeting on page P6)*

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# ACTIVITIES OF THE LOCAL SECTIONS

**Southeastern Section Officials for 1955**

SEATED (l to r): Thomas M Ferguson, National Aniline Div; John C Cook, "Textile Industries"; T Howard McCamy, Pepperell Mfg Co; James W Swiney, Fulton Bag & Cotton Mills; William B Amos, Stein, Hall & Co.

STANDING (l to r): A Kempton Haynes, Rohm & Haas Co; Robert K Federal, General Dyestuff Co; K D Henry, Textile Aniline & Chemical Co; Robert B Hallowell, Clark Thread Co; Gustav von Metnitz, Adelaide Mills; Harold W Berry, Cedartown Textiles, Inc; William E Fayssoux, Royce Chemical Co; William B Griffin, Dexter Chemical Corp; H Gillespie Smith; American Cyanamid Co.

**SOUTHEASTERN**———**The Southeastern Section held its final session of the year at the Atlanta Biltmore Hotel, Atlanta, Ga, on December 11th. Featured speakers were R Hobart Souther, Cone Mills, on "Stream Pollution", and Robert Ford, Dow Corning Corp, on "Silicones and Their Application on Textile Fabrics".**

**Officers for 1955 were elected as follows: *Chairman*———T Howard McCamy, Pepperell Mfg Co; *Vice Chairman*———James W Swiney, Fulton Bag & Cotton Mills; *Secretary*———John C Cook, "Textile Industries"; *Treasurer*———R B Hallowell, Clark Thread Co; *Councilors*———William B Griffin, Dexter Chemical Corp, and S Jack Davis, The Chemstrand Corp; *Sectional Committee*———Harold W Berry, Cedartown Textiles, Gustav von Metnitz, Adelaide Mills, Robert K Federal, General Dyestuff Co, and Thomas M Ferguson, National Aniline Div, Allied Chemical & Dye Corp.**

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**WASHINGTON**———**The Washington Section on December 8 joined other member bodies of the Inter-Society Color Council in a meeting at Pepco Auditorium in Washington. Dorothy Nickerson, chairman of the local ISCC group and of the Illuminating Engineering Society, opened the meeting by introducing officers of each of the groups represented. These included AATCC, American Institute of Architects, American Institute of Decorators, American Society for Testing Materials, Illuminating Engineering Society, and the Washington Colorists.**

**Approximately 175 members of the various organizations were on hand to hear Ralph M Evans, director of the Color Technology Division, Eastman Kodak Co, present an illustrated talk on "Creative Directions in Color Photography".**

**The Section has elected the following officers for 1955: *Chairman*———George S Buck, Jr, National Cotton Council; *Vice Chairman*———George P Fulton, National Institute of Drycleaning; *Secretary*———Nelson F Getchell, National Cotton Council; *Asst Secretary*———Suzanne Davison, U S Dept of Agriculture; *Treasurer*———Louis R Mizell, Harris Research Laboratories; *Councilor*———Lawrence L Heffner, Wm E Hooper & Sons Co; *Sectional Committee*———Robert J Grant, Young Aniline Works, Inc, Margaret S Furry, U S Dept of Agriculture, Robert T Graham, National Institute of Drycleaning, and James H Kettering, Naval Research Laboratory.**

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**WESTERN NEW ENGLAND**———**Approximately 50 members and guests were present for the December 10th meeting of the Western New England Section at Rapp's Restaurant, Shelton, Conn. Robert H Phillips, Cranston Print Works, gave a talk on "The Use of Resins in Producing 3-Dimensional Styles on Cotton Fabrics".**

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**PACIFIC SOUTHWEST SECTION OUTING (PHOTO CAPTIONS)**

1———L Olsen, Ciba; Mr & Mrs Campbell, Pacific Textile Processing Co
2———Mrs F Thatcher
3———H Ellsworth, West Coast Carpet Dyers; T Lee, Geigy; R Anderson, Modern Dyers; E Lindquist, Geigy
4———Mr & Mrs W Jones, United States Testing Co; Mr & Mrs M Behrendt, Catalina, Inc
5———A H Roberts, Jacques Wolf
6———R Anderson, Modern Dyers
7———Mr & Mrs S Springer
8———Mr & Mrs Carlin; H Pike, Los Angeles Piece Dye; J Green
9———F Thatcher, Modern Dyers
10———Mrs H Ellsworth
11———R Mishell, Dyemasters
12———H Salomon and W Wigglesworth, United Piece Dye Works; T Lee, Geigy
13———A Smidicor and E Meshke, UCSB; Dr & Mrs S Dadone, L A Piece Dye Works
14———Mmes F Thatcher, R Anderson, A H Roberts, and E Lindquist
15———M Kramer, Hollywood Hand Prints; J Smith and R Mishell, Dyemasters
16———A Mease and Mr & Mrs F Ahl, Du Pont
17———J Cooper, Dyemasters
18———Mr & Mrs J Nehmens, Du Pont; Mr & Mrs T Smock, General Dyestuff

## *Membership Applications*——

*(Concluded from page P2)*

*Harold Kfare*—Jr stylist—Menswear Dept, Robbins Mills, New York, N Y.

*Enrique C Orbea*—Selsa, S A, Buenos Aires, Argentina.

*Rudolph Rieg*—President, Pad-Dye Corp, Paterson, N J.

*William B Shea*—General mgr, Hy Grade Textile Co, Lawrence, Mass.

*Arthur J Williams*—Vice-pres, Willtaub Chemical Corp, Long Island City, N Y.

*STUDENT*

*Clarice Garrett*—Pennsylvania State University. Sponsor: M P Shelton.

*Ann I Hauser*—Pennsylvania State University. Sponsor: M P Shelton.

*Jessie A Warden*—Pennsylvania State University. Sponsor: M P Shelton.

*Alice A Wojtowicz*—Pennsylvania State University. Sponsor: M P Shelton.

*Daniel F Crean*—Lowell Tech Inst. Sponsor: G R Griffin.

*George E Lanciault*—Lowell Tech Inst. Sponsor: G R Griffin.

*William H Brem, II*—North Carolina State College. Sponsor: H A Rutherford.

*Robert V Clarke, Jr*—Georgia Institute of Technology. Sponsor: J L Taylor.

*James E Farrington*—R I School of Design. Sponsor: H B Sturtevant.

*APPLICATION FOR TRANSFER TO SENIOR MEMBERSHIP*

Norman H Berland
David H Hellman
Dewey T Thompson

## ANNUAL OUTING——PACIFIC SOUTHWEST SECTION——OCTOBER 30, 1954——OJAI, CALIFORNIA

*(See captions on page P4)*

(Courtesy of A H Roberts, Jacques Wolf & Co)

# ANNUAL MEETING——RHODE ISLAND SECTION——DECEMBER 2, 1954
## CROWN HOTEL, PROVIDENCE, R I

(Photos by J Trexise, Onyx Oil & Chem Co)

## 33rd Annual Convention——

# ANNUAL BANQUET

THE Annual Banquet, traditional finale for AATCC Conventions, was held in the Exhibition Hall of the Atlanta Biltmore Hotel, Atlanta, Ga, on Saturday evening, September 18, 1954.

Convention Chairman C Russell Gill called the session to order at 7:30.

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*C Russell Gill:* We will have the invocation by our beloved past president P J Wood.

* * * *

*P J Wood:* Direct us in all our doings with Thy most gracious favor that in all things begun, continued and ended in Thee, we may glorify Thy holy name. Bless, oh Lord, this food to Thy use and us to Thy service, and give us thankful hearts. Amen.

* * * *

*C Russell Gill:* Honored guests, ladies and gentlemen, welcome to the banquet of the 33rd National Convention. We are glad you are here, all 1639 of you. Our total registration was 1639 members, guests and friends.

The Executive Committee for this convention thought it was most appropriate that we invite the Chairman of the Washington Section to be our toastmaster. In my opinion, this man is the most versatile man in the association.

As a scientist, he was the second winner of our cherished Olney Medal. As a golfer he plays from scratch. He is the only real, honest-to-goodness extrovert PhD I ever knew.

I give you Milton Harris.

* * * *

*Milton Harris:* Thank you, Russell. Mr President, honored guests, members and friends, after that introduction, I can hardly wait to hear what I am going to have to say!

The only reason I am back here is because I didn't have the price of one of those front-row seats. But it is indeed one of the real and great pleasures of my life to have this privilege and opportunity to take a part in this wonderful convention of this association.

The Southeastern Section, along with the other sections of the Southern Region, I think, should have every congratulation for the grand job that has been done, and I think you will agree with me that the chairmanship of our good leaders, Russell Gill, and his various committees has been outstanding.

As a matter of fact, our Chairman has been so efficient that only a few days ago I got a letter which actually listed the number of minutes which each person partaking in this program was to be allotted. It was rather discouraging for me because I had already spent two or three weeks working up two or three hours of spontaneous remarks.

I am going to put all of you at ease, as all of us who are going to take part in this program have agreed to adhere to this schedule, and for those of you who may be Doubting Thomases or sticklers for scientific accuracy, I just want to warn you it isn't going to embarrass us a bit when you start looking at your wrist watches; only when you start shaking them.

As I look over this magnificent gathering with so many outstanding leaders in our industry; as I look over this wonderful array of past and present leaders of our great association, more especially as I look down here and see so many of the wonderful toastmasters we have had at some of our earliest meetings——P J Wood, whom I consider the dean; Sam Hayes, George Linberg and others that I have heard——I am honestly a bit overcome. I feel just like I did 20 odd years ago when I moved to Washington and did what everybody else does when they move to Washington; I did a lot of sightseeing.

Late one afternoon I went down to the Washington Monument. The sun was setting. It is really a magnificent sight. It was standing out silhouetted against the sky. I was overcome looking at it. I stared at it and as I stared at it, I suddenly noticed another gentleman who was looking at it, too. I soon noticed he had perhaps been to a cocktail party or something. He looked at it and he wandered around to the other side and he looked at it then, and he reversed his direction and looked at the other side. He did this four or five times and an air of bewilderment and perplexity came over his face. Finally, he came over and said, "Bud, we'd better give up, we are really walled in."

If you will just permit me a serious moment, I should very much to point out that our mission here as individuals is a very serious one and our mission here as members of this association is a very important one indeed. I wonder how many of you realize the great responsibility that this particular association has in fulfilling the role of what I consider to be the most important liaison organization between two of our greatest industries?

On the one hand, we represent the textile industry, which is one of the oldest, one of the largest, one of the most important industries the world has ever known. It is an industry which most people forget was responsible for our industrial revolution, from which sprung all of modern industry. It is an industry that is so large with all of its allied industries, it is probably one of the largest employers in the world. It is frequently referred to as the No. 1 customer of the chemical industry.

On the other hand, we represent that same chemical industry. True, it is a very young industry, although it is beginning to assume gigantic proportions. It depends in an important way on the textile industry. I do not know of a single major chemical company which either directly or indirectly does not have a significant part of its business tied up with the textile industry.

And finally, I think that it is particularly noteworthy that twice in our lifetimes, twice in this century, the textile industry has had a most profound effect on the chemical industry because, as many of you know, it was the demand of synthetic dyestuffs during the first 50 years of this century which helped capitalize the growth of the tremendous industry which is known as the field of organic chemistry. And there are those who feel that the demand for synthetic fibers will be the most important aspect in the growth of the chemical industry in the latter half of this century.

I think all of you here tonight can feel justly proud of the role you have had in the development of these two industries, which have had such profound effects on all industry, on the growth of our country, and I think, on the whole world.

Now, I'd like to come to one of the really pleasant assignments I have tonight, and that is the introduction of the men at the head table, the men who in the past or present are leading this organization and who have done so much to build it. But before I introduce them, I should like to express my regrets that some of our grandest people were

not able to be here. We have had letters from them and I'd just like to mention them.

*(A list of names of those who could not attend was read by Dr Harris).*

I should like also to mention our great and good friend, Bill Appel, who had to leave because of duties in Washington. I am truly sorry he wasn't here because I would personally like to have had the opportunity to pay my respects to this year's Olney Medal Award winner.

I feel very keenly about this because Bill Appel really gave me my start in research. I was research associate in this association under him back in the early 30's. There's really so much to say about Bill Appel that I feel very much in the situation of one of our famous comedians, Joe E Lewis.

One of his famous quips always deals with money in some form or other, such as, "Money isn't everything, it just goes a long way towards soothing the nerves."

I happened to hear him at the club one night as he was giving this patter, and in walked Joseph Kennedy, who was formerly our ambassador to Great Britain, and one of our great financiers. Lewis waved and said, "Hello, Mr Kennedy." All the audience started applauding. Lewis acted a little flustered, stopped the audience and said, "Look folks, I am not being nice to Mr Kennedy just because he has money. It is because he has a hell of a lot of it."

I am not being nice to Bill Appel because he is this year's Olney Medal Award winner. It is because for some 30 odd years, he's been one of the really great contributors to this organization in almost every capacity one could imagine.

Now, I should like to introduce the people at the head table. I am going to follow the usual pattern and ask you to refrain from applauding until we get through.

On my far right, we have the new assistant secretary, Richard Frey. I should like to tell you just in passing that this has been my first chance to meet him. He is quite a superman; a super salesman, at least. He extended his right hand to shake hands and he had a corporate membership application blank in his left. It is the fastest deal I have ever experienced.

Next we have Dr Harold Stiegler, our director of research; Paul Wear, the assistant general chairman; Charles Dorn, chairman of the Technical Committee on Research; Leonard Little, chairman of the Executive Committee on Research; my old golf professional, Henry Herrmann, one of our past presidents; Tom Smith, past president.

Now, slipping over here, one of our most famous toastmasters, Sam Hayes, vice-president; Joseph H Jones, vice-president, who had so much to do with the running of the wonderful meeting we had in Chicago last year; George Baxter, vice-president, a newcomer; George Linberg, vice-president.

I had the occasion to play golf with George. We were playing up in New England and it was a very wooded course. He is one of the longest hitters I have seen, but not one of the straightest. And on the first hole, he sort of pushed the ball out to the right and said, well, he didn't get through it quickly enough, too much right hand, or something like that. He did the same thing on the second hole. At the third hole, he came to a narrow fairway and the ball went off at a right angle. He immediately dashed into the woods after it. The caddy dashed in, and I went in, and I heard George hollering to the caddy, "The hell with the ball, come find me."

P J Wood, the dean of all of our toastmasters; Harold McCamy, chairman of the Southeastern Section; Henry Rutherford, chairman of the Piedmont Section; Albert Sampson, treasurer. (I understand you are going to do very well this week, Al). Dr Harold Chapin, our ever-beloved secretary, the man who really does all the work, takes all the blame, but I hope, will receive all the credit; Paul Anderson, chairman of the South Central Section; Raymond Jacoby, chairman of the 1956 Perkin Centennial Committee.

These are your people!

Your assistant convention chairman, Paul Wear, would like a word.

* * * *

*Paul G Wear:* I'd like to direct my remarks to a man who has spent no end of time in the planning and staging of the 33rd convention, Russell Gill.

Russell, the entire Convention Committee wants you to know it's been a privilege and a pleasure to serve with you, and in rememorance of this, it gives me the deepest personal pleasure to present you with this watch from the Association.

* * * *

*C Russell Gill:* Thank you. I appreciate it. I guess it is an expression of thanks from the four host sections for having headed up the committees that worked on this convention, but one guy can't do this job. It took more than a hundred. Some of them are out in front of you right now.

I am going to call on some members of the Executive Committee here tonight: Wyss Barker, chairman of the transportation; Joe Bohannon, Jr, chairman of the dining facilities; John Sweitzer, chairman of the entertainment; John Cook, chairman of the exhibits, James Swiney, chairman of finance; William Griffin, chairman of the ladies' department; C Norris Rabold, chairman of the Membership Committee; Junius Smith, chairman of printing; Arthur Thompson, chairman of publicity; Adam Fisher, Jr, chairman of reception; Gillespie Smith, chairman of reservations; Kempton Haynes, chairman of registration; and of course, Walter Scott, chairman of the Technical Program Committee.

The rest of this beautiful crowd in front of you belongs to those at the head table or to the gentlemen who are now standing. If the girls will stand up and take a bow, they deserve a hand too.

I thank you.

* * * *

*Milton Harris:* Now, we are going to take a few moments and return to the scientific part of our meeting.

(*Editor's note:* Dr Harris' interest in flying saucers may not be of sufficient interest to all our readers; however, those attending the Banquet were thrilled by his commentary).

We have awards to present for the outstanding paper published in the *Proceedings* during the past year, and for the Intersectional Contest winners.

I should like to introduce Percival Theel, chairman of our Publications Committee.

## AMERICAN DYESTUFF REPORTER AWARD

*Percival Theel:* Mr President, Mr Toastmaster, honored guests, ladies and gentlemen, this is one of the pleasant jobs that one gets in the year as a result of the work in the Publications Committee. Tonight I have the privilege of announcing the winner of the annual AMERICAN DYESTUFF REPORTER Award.

**Presentation of the ADR Award**

Four years ago, through the generosity of the AMERICAN DYESTUFF REPORTER, it was established that an award of $200.00 for the individual, who in the judgment of the Committee had the best paper published in the *Proceedings* of the association, would be given. This includes papers presented before Sections, and papers presented at the annual convention, but not Intersectional Contest papers.

The winner this year is Charles L Zimmerman, American Cyanamid Company, for his paper "The Application of Dyes to Textile Fibers at High Temperatures." This was published in the *Proceedings of AATCC*, in the *American Dyestuff Reporter* of September 14, 1953, Volume 42, No 19.

If Mr Zimmerman is here, I wish he'd step forward.

While he is coming up, I want to express appreciation and thanks of the Publications Committee and myself to the Committee on Awards, to John Dalton, Alfred Macormac and James Dean, who made the selection from all the papers published during the year.

Mr Zimmerman, I congratulate you and here is your award.

*Charles L. Zimmerman:* Thank you very much sir.

* * * *

*Milton Harris:* I should like now to introduce the man who's always done such a wonderful job as chairman of our Intersectional Contest Committee, Frank O'Neil.

* * * *

## AWARDING OF INTERSECTIONAL CONTEST PRIZES

*Frank J O'Neil:* I would like first to thank the National Sectional Contest Committee, Tom Smith, John Gould, Bob Brown, Earle McLeod and Jack Woodruff for their cooperation in making this year's contest a success. May I also take this opportunity to thank Roland Derby, Sr for acting as Chief Justice in the 1954 contest. Mr Derby is the third Chief Justice since the contest has been in existence. It will probably be recalled that our first Chief Justice was the late Professor Olney; the 2nd Chief Justice was Bill Appel. In spite of occasional criticisms and expressions of a desire to eliminate the contest, it has gradually developed into a well integrated contest highly regarded by the majority of the AATCC members. We have enjoyed welcoming this year a judge representing the Pacific Southwest Section, George Moisson. We would like to have Mr Moisson stand and take a bow.

Now is the time to start the ball rolling on the 1955 contest. I have been informed that several sections have made good progress already. We earnestly request that other sections consider immediately a course to follow towards presenting a paper for the 1955 contest.

We have now arrived at the most important part of the contest, the naming of the winners. As in the past, I will begin by reporting Third Place, Second Place and finally the First Place Winner. The selections are Third Place—Rhode Island, Second Place—Piedmont, and First Place—Washington.

I have here, standing behind me on the platform, representatives of each of those sections ready to take a bow. For Rhode Island may I present Jim Redmond; for Piedmont, Hobart Souther; and our First-Prize winner, Dr Frishman representing the Washington Section.

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*Milton Harris:* I have been instructed that there is at least one part of the meeting during which I am supposed to be dignified, and that is the time I introduce the president, our good friend, Bob Bonnar.

Don't misunderstand when I say it is hard to be dignified when one is introducing Bob Bonnar, not because he isn't dignified, but because he is truly such a wonderful person.

As President, as Chairman of many committees, just an ordinary member, he's never changed. He is just a very wonderful person.

## PRESIDENT'S ADDRESS

*J Robert Bonnar:* I have a forty-minute speech, they tell me I have twenty to make it in, and now he rips it up (indicating torn manuscript.)

I got a watch out of it anyway. *(Taking Dr Harris' watch).*

Russell, I don't think there is any need to say "thank you." As a representative of all the members of this association, you know what type of a job has been done from the smooth way this has run, and so without further ado or any "thank you" I will go on with a few words of message that I have tonight.

The progress of this association, and it has been good over the last two years, I talked about at the annual meeting. Not enough of you were there, but some of you were, and you heard me at that time.

My speech, so ably ripped up by our toastmaster a minute ago, had 88 pages of notes, which, if I were to write a formal speech, would be entitled, "Confessions and Suggestions," or something along that line, because I have several things I would like to say tonight as suggestions to the incoming officers, and as a confession of those things that did not get done under my regime that I would like to have seen done.

The officer has to take the blame for any action or inaction of the organization, and so I take the blame. I hope these shortcomings will be corrected at a future date. In order to save time, I will go over them quite lightly but list them as I go along.

The first thing I think should be corrected is the fact that our very able vice-presidents do not, according to our tables of organization, as yet have enough to do. I think they could very well have some projects directly under their jurisdiction, perhaps saving the president some time, but not necessarily that so much as doing an even better job for the Association.

Secondly, I think we could well bring along some younger men. We have tried this year ——— Ed Leonard, Charlie Sylvester, Bob Allison, some others that I will not try to remember at the present time. We brought those fellows in, but we need more. The older men who have been in this thing a good many years have done a good job and I don't mean to discredit them, but the younger fellows have new ideas.

As we get older, we want to let up a little. If we don't train the young fellows, it doesn't do any good. One can't take the bus boy and make him the steward of the dining room without his going up through the ranks. I think we have to be awfully careful that we have the right young fellows coming along, and that they are being trained.

Thirdly, I think we should continue to investigate the possibilities of developing test methods in fields which our members want, even though some of us may think such tests are not within our jurisdiction. If the members want them, we should endeavor to set up some sort of committee. If we can't do it, then we should get outside help.

One very good example is the problem of dermatitis. I believe we should establish a committee on this subject. We could get help from organizations such as the American Medical Association and others. It would be a real service to our members.

At an AATCC symposium last Spring in New York, I suggested that we should further encourage some of the other associations to come in with us on certain test methods. Sometimes our association does something which causes other societies to ask, "Why are they doing that? We think we should be doing it!"

It seems to me that there could be established a steering committee which would coordinate our activities with those of other societies and prevent duplication of effort in many instances. We ought not go ahead on our own in tackling many of these problems without first talking with other associations. We have been very lax in this, and I think if we would be more cooperative, we would have other associations know us better.

Let me get a little personal now, if I may. I believe it's 27 years that I have been on committees doing work in AATCC. I have enjoyed every minute of it from the time Arthur Hearst and Alden Nute were too busy to go to a meeting of the Research Committee. Maybe they were making seconds, probably trying to cover them up with black.

I had to go to the Research Committee meetings in Boston. Attending were Dr Olney, Walter Scott, Bill Appel, Hugh Christensen, Alex Morrison, Dr Meyer, perhaps some others, and I felt that this was quite an organization. I thought it would be nice to help out, do my bit for the industry, and I have tried to do it ever since.

And so tonight, I would like to take just a minute or two, which I think is within my allotted time. If not, pull my coattail, Milton, Russell, one or the other of you, and I will stop.

I want to express my appreciation to the many men in the Association who have helped me.

Among them is Al Sampson. He has always been ready to draw off charts and tables, and tell me about the money "in the till," so we would have a little indication of this, that or the other before we went to a meeting. In addition to that, he has worked on our marketing problems.

With the *Colour Index* he has had to tackle problems of international currency, duties, bindings, market distribution, etc. Why? Because we have about $120,000 riding on this project. His committee is right on top of it all, with Al as the spark plug.

Another is Bill Cady, who for many, many years has been right in the thick of things for the Association. He has had a good background, and he has helped me immensely.

Ken Barnard has been of immeasurable help as chairman of the National Convention Committee, while in research, Harold Stiegler, Leonard Little, and Charlie Dorn have been the kingpins.

Henry Herrmann has offered many, many valuable suggestions because he thinks things out well, and because he's been "through the ropes." We go to lunch together and discuss this or that. Those subjects on which we don't always come to an agreement, we let drop, and go through them the next day. I appreciate help like that.

I appreciate the help I have had from the office, and the time they have given me. The bosses, including Bill Williams here, never questioned for one minute the time I had to give to AATCC. They knew it was for the good of the industry, and they looked at it as a job that should be done.

**J Robert Bonnar delivers the President's Address as Southern regional vice president Samuel L Hayes registers approval**

I have not overlooked the secretary. I withheld mention of him till the last because I wanted to say this. He's had a lot of experience, and he doesn't write a letter and say, "Why in the name of fortune didn't you do so and so?" He doesn't say afterwards, "I could have told you so." He puts a penciled notation on the bottom of some report, "Don't forget so and so for next month," or he sidles up at a meeting and says, "I suppose you are thinking of so and so for the next meeting or next month or next this and that."

I appreciate the spirit in which Dr Chapin has given me valuable advice.

I want to tell Fran that I promise very faithfully within the next two years to always take her to the movies if I can. If I can't, I promise within the next five years I positively will take her to the movies, unless I have something else to do. She has been very good and very patient. I want her to know I appreciate it.

Now, that glance — all she does is turn around. Have you ever marvelled at the circus when, all of a sudden in the third or fourth act, out comes an automobile from which emerges one person, then two, three, four, sixteen, seventeen, nineteen, twenty people — all out of that little automobile? That has nothing on a woman's glance. This particular glance can mean many things, but in this case it just meant, "You are all done, Bonnar, shut up and sit down."

So I will do that, but I want every member of this association to know that I appreciate the things that have been done. I also want to say that whatever I have put into this, whatever good I may have done, I have gotten back many fold.

Thank you very much.

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*Milton Harris:* He is a wonderful fellow, and he is a politician because that was no glance!

(Toastmaster Harris then turned the meeting over to Russell Gill, who introduced "Coach Bob Fumble of Siwash College". Coach Fumble gave a refreshing dissertation on the trials and tribulations of a college football coach before he was revealed to be Warren Foster of the Coca-Cola Company.)

*(Concluded on page P17)*

*33rd Annual Convention——*

# PROCEEDINGS OF THE 1954 OLNEY MEDAL LUNCHEON*

THE 1954 Olney Medal Award Luncheon, held in the Ballroom and the Crystal Lounge of the Atlanta Biltmore Hotel, Atlanta, Ga, on September 16th was called to order by Convention Chairman C Russell Gill at 12 noon.

After calling on Chaplain Easias of the Peachtree Methodist Church (Atlanta) to give the invocation, Mr Gill officially welcomed the gathering and introduced Samuel L Hayes, AATCC vice president (Southern Region), as the presiding officer.

Mr Hayes then introduced the following men seated at the head table: Harold W Stiegler, AATCC director of research; Albert E Sampson, treasurer; Charles W Dorn, chairman, Technical Committee on Research; Leonard S Little, chairman, Executive Committee on Research; Henry A Rutherford, chairman, Olney Medal Award Committee; Albert E Johnson, chairman, Corporate Membership Committee; Harold C Chapin, secretary; and C Merrill Lofton, manager, Atlanta Field Office, Dept of Commerce.

Following a tribute to Mr Gill as the "workingest bee" at the Convention, Mr Hayes introduced past president C Norris Rabold.

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*C Norris Rabold:* Thank you Mr Toastmaster, distinguished guests, ladies and gentlemen.

As you know, this association at its annual meetings is constantly bringing forth "firsts". At every convention, we, as scientists, should develop something new. This year we feel we have a distinct innovation in the Corporate Members' Day, something that your Convention Committee thought up, and I think it was indeed an inspired thought on their part.

We depend on corporate members, as you know, for the support of our research activities. These activities have grown tremendously, and are continuing to grow and to expand, which means that our contributions, our dues, our funds necessary for the support of research activities must in turn expand.

Much of the work is done by you gentlemen who are volunteer members of the association. You spend freely and give freely of your time, your intelligence and your capabilities. Without that, we would not get anywhere.

We also depend to a considerable extent upon the permanent staff at Lowell. That staff is being called upon more and more to co-ordinate and work with the volunteer members of the Association, bringing forth their own research program.

In this Association we have five classes of members: student, junior, senior, associate and corporate. Generally, you can look around and see a senior, junior or an associate member. By that I mean, they are sort of visible entities.

Corporate members are supposed to be relatively invisible. We are here today, gentlemen, to prove to you that this is not the case. They *can* be made visible,

* Held on September 16, 1954 at the Atlanta Biltmore Hotel, Atlanta, Ga.

## HEAD TABLE—OLNEY MEDAL AWARD LUNCHEON

**(L to r): Harold W Stiegler, AATCC director of research; Albert E Sampson, National Aniline Div, treasurer; Charles W Dorn, J C Penney Co, chairman, Technical Committee on Research; Leonard S Little; chairman, Executive Committee on Research; Henry A Rutherford, North Carolina State College, chairman, Olney Award Committee, and chairman, Piedmont Section; Albert E Johnson, National Institute of Drycleaning, chairman, Corporate Membership Committee; C Norris Rabold, Erwin Mills, Inc, past president; William D Appel, National Bureau of Standards, 1954 Olney Medalist**

**(L to r): Samuel L Hayes, Ciba Co, Inc, vice president (Southern Region) and toastmaster; W R Brode, National Bureau of Standards, who spoke on "The Medalist—The Scientist"; J Robert Bonnar, General Dyestuff Co, president; Merrill C Loftin, Dept of Commerce; C Russell Gill, Southern Sizing Co, convention chairman; Rev John Easias, Peachtree Methodist Church; Harold C Chapin, secretary**

and we are privileged indeed to be their hosts at this annual meeting. We very much appreciate the willingness of their representatives to take the time to come and visit with us and see our workings at our annual meeting.

(Mr Rabold proceeded to introduce a number of representatives of the corporate member firms. He thanked them and their companies for assisting in the program, and expressed the hope that they would return again and visit with the Association next year).

* * *

*Samuel L Hayes:* Thank you, Norris, and may I express to the corporate member representatives who are here today our gratification and our thanks for being present.

One should pick a good man for a difficult job, but today we have picked a good man for what we know he will consider a most pleasant and easy task. Our speaker today was born in the early part of this century. He received his BS degree from Whitman College in 1921, his MS at the University of Illinois in 1922, and his PhD from the same school in 1925.

During the years 1923 to 1928 he was with the National Bureau of Standards. From 1928 to 1949 he held the professorship of organic chemistry, Ohio State University. In addition to his manifold teaching duties, he found time to do research work in color, dyestuffs, and spectroscopy and during this period directed the work of some 40 to 50 students pursuing their PhD's. In 1949, he returned to the National Bureau of Standards as assistant director, which position he now holds.

He is the author and co-author of some 106 papers published from 1924 to 1954 covering a wide range of subjects, both theoretical and practical.

One of his first papers was published in the *Journal of Industrial and Engineering Chemistry* in 1924. The subject was "Spectrophotometric Analysis Applied to Chromotrope 10B" and in 1925 he published the following paper, "Standardization of Agalma Black 10B." On both of these papers a bright, young, handsome, aspiring youth named William D Appel collaborated.

All his papers were not so serious, eg, his treatise in 1935 on "Scientific Ballyhoo in Advertising." And Doctor, may I suggest that you rewrite that paper today and turn it over to the TV stations.

His education, his research work, his writings are sufficient to justify his presence here today, but that is not why he is here.

He is here because, as a firm, staunch friend, he has known Bill Appel for some thirty years. And so Dr Brode, may I introduce you, not as the learned chemist you are, not because of your educational achievements, not because of your research and your technical contributions, but because of something which to us is far more noteworthy.

Ladies and gentlemen, I now present to you Dr Wallace R Brode, associate director of the National Bureau of Standards, Dr Brode.

WALLACE R BRODE

*Dr Brode:* I would like to start with a brief notation of two advertisements that appeared in July. These two advertisements are slightly different in their form, but they both have something to do with this particular occasion.

I am sure you won't be able to see this advertisement, but you have probably seen it before in our current magazines, the one-eyed shirt man. Here is an advertisement with a beautiful background, looking like something taken out of the *National Geographic*, a view from far-off India, with elephants, beautiful red trimmings and trappings, in front of which stands the one-eyed hunter.

The advertisement reads:

"This shirt is made of Indian madras which imports from India. This is the real stuff, woven by Indian cottagers on their hand looms. Each piece is only 8 yards long, enough for three shirts. The pattern never repeats itself, so that you will never see another man wearing the same shirt as yours.

"One of the great charms of the genuine Indian madras is that the colors blend so perfectly, bold and daring as they are; the natural dyestuffs used by these Indian cottagers are *not completely fast. They fade a little with washing and with sunshine.*

"This gives the shirt a look of *good breeding*, and *maturity* which no mass-produced fabric can aspire to".

The second "advertisement" was not, I am sure, paid for by Bill Appel himself; yet it shows his picture on the front page of *Chemical and Engineering News*.

In this announcement, just the opposite point of view is taken.

"Housewives can claim a proprietary interest in William D Appel since he is a chemist who has done much to make color-fast fabrics what they are today".

These are the two sides of the current competition in literature. Actually, this second article is really an honor which the American Chemical Society, of which I am a member of its Board of Directors, is particularly pleased to accord to Mr Appel, to recognize his achievements in the field of the testing of fabrics, of dyes and fabric material.

My acquaintance, as has been mentioned in introducing me, with Bill Appel has been over many years, going back to 1922. In fact, I am not the senior author on a series of papers published then but rather the junior author. Appel was my boss, and working for him was a distinct pleasure.

I went to the National Bureau of Standards in 1922 when I was a graduate student at the University of Illinois. While there I got acquainted with a number of people and found that I could use the facilities of the Bureau to expedite my dissertation work. My Doctor's thesis was on the Mechanism of Dyeing of Fibers, the problem being whether the mechanism was a physical or chemical process. We applied a number of optically active dyes to fibers to see whether dyes would be selectively absorbed. The process of determining the degree of absorption appeared to require very careful dyeing and very careful measurement of the intensity of the dyed material and the amount of dye remaining in the liquid.

To do this, I sought Mr Appel's assistance, and in this process we used the powdered wool processes which he had developed in his special dyeing vats. Our results were negative in the sense that we were unable to show any preferential absorption of the dye by the naturally asymmetric forms of wool or cotton.

While I was still working for my degree, another laboratory, which did not have the very good advice that Mr Appel could give as to measurement of dye intensity and rate of absorption, published a paper on the same subject, but with the opposite conclusion. They felt that they had observed differential absorption and, therefore, they claimed that dyeing was a chemical process rather than a physical process. Roger Adams insisted that I repeat all the work of this other laboratory just to be sure that we were right and they were wrong.

The "other" laboratory's conclusion appeared first in the literature, and in some subsequent literature it is stated that "Dyeing is a chemical process as has been demonstrated". And only occasionally is there an asterisk or footnote which says "Brode and Adams found differently."

At least, the decision had been somewhat in doubt until just this year.

On the occasion of the Adam's retirement, I was pleased to have had the opportunity to prepare an address on "The Mechanism of Dyeing", as it forced

me to go into the literature and do some reading on this subject, which was covered in a recent symposium under the auspices of the Faraday Society. I noted that in the preparation of a paper on the absorption of asymmetric materials upon wool and cotton, the work which we had done some 30 years ago as well as the work of the others was carefully repeated. It was gratifying to note that the conclusion was the same as ours, namely, that there is no difference in the absorption of the asymmetric forms of wool.

The precise measurements available at the National Bureau of Standards in Mr Appel's section were the key to the original measurements on this subject.

Mr Appel has been with the Bureau of Standards since 1922 as chief of the Textile Section.

I would like to point out very briefly some of the functions of the National Bureau of Standards, indicating how well Mr Appel has performed these as his principal service to textile technology.

A few years ago, upon the celebration of the 50th anniversary of the founding of the National Bureau of Standards, it was deemed advisable to try to revise the functions assignment of the National Bureau of Standard's work in accordance with the advance of science.

Fifty years is a long time when you are in the competitive race of science. Such things as radio and aviation were unknown at the time the Bureau was established and many of the functions, the things which we were doing, were never authorized by law in the original authorization; we were doing them just as a part of the advance of science. While it appears that Congress passed the law, we helped write it and we tried to describe what we felt were our present functions.

The first of these functions was standards and standardization. We, of course, maintain the meter bar and kilogram, the various basic standards of length, of mass, of time and the more complex standards. Standards of light, standards of color, of viscosity, temperature, hydrogen, ion concentration, and many others formed the background and basis of those which funnel through into the textile area to provide basic standards for reference in many fields of activity.

Among these are standards of fastness and fading standards. These Mr Appel himself has contributed to the long list of basic standards which the National Bureau of Standards provides to industry and science.

The second function of the National Bureau of Standards is the determination, tabulation and distribution of physical constants. It may seem that there are not many real good, physical constants that can be applied in the field of textile and chemical knowledge, but actually there are many. For example, the properties of textile materials themselves become physical constants. In fact, there has been issued this year a new edition of the Smithsonian Tables in which one may find a very good tabular discussion of textile materials. One will also find some asterisks indicating preparation by William D Appel, National Bureau of Standards, as evidence of his activity in the compilation of physical constants and other reference materials. I would like to point out that other parts of the Bureau also are very active in providing this industry with many of its important tools.

There will appear shortly, as a circular published by the National Bureau of Standards, a survey on color nomenclature, indicating the separate names by various systems and tying each of them to the others. It will include some systems that have numerical values, which should be very useful in translating the names. Where something is listed in the literature of color as "check" or something like "pink-2G", and where this is listed elsewhere as a "flesh color", one will be able to assign the proper color values and refer to standard color indices for these particular shades.

The third assigned function of the National Bureau of Standards is testing and the development of methods of testing. This function is concerned largely with government purchases because we are the laboratory which determines the quality and character of material purchased by the government, and which determines whether it conforms to the assigned values or specifications upon which the purchase has been made.

Within the National Bureau of Standards, of course, there are many testing instruments that have been devised. In the areas of textiles, dyes and color, important machines have been developed for the determination of wear and the effect of impact, fading, washing, aging, etc, and many other important devices, methods of dyeing, the methods of measuring infrared, the dyeing rates through the powdered forms of dye and many other things have developed as methods of test.

We are also authorized to cooperate with the government and private agencies in the preparation of codes, specifications and other generally useful information items. In such codes and specifications, advantage is taken of the availability within the National Bureau of Standards of experts in other fields. For example, if some sort of a general code or specification on size of garment material is to be prepared, this is referred back to various agencies, various parts of the Bureau, the people that work in statistics, mathematical design of experiments, etc, whereupon they set up the various perameters upon which we draw conclusions. They, as well as Mr Appel himself, have been very active in the general size determinations, the number of different sizes of fabric items to be made available.

We also prepare codes and specifications on color. There is a handbook of color for government supply and purchase, so that if anyone wants to know the particular color of the mailbox, the army jeep, the school bus, or whatever it may be, all of these are carefully defined so that there can be some uniformity in the government's regimentation, one might say, from the color point of view. This applies not only to paints, but to decorative materials, fabrics, and other types of substances as well.

We are asked to prepare specifications on the composition of fabric material, the fastness to washing and aging, the fading and even the fire resistance. Mr Appel has been very active with the Federal Specification Boards, Federal Trade Groups and other groups on the preparation of specifications with regard to fire resistance of flammable fabrics.

The fifth function this Bureau, one in which Mr Appel has been very active, is generally referred to in our articles of Enabling Act as advisory services.

A law passed by Congress in 1932, entitled the "Economy Act," provides that, if money is appropriated to one part of the government for a certain function or operation, before this particular agency proceeds to build a new laboratory and hire any new personnel and buy new equipment, they should first look around throughout the Federal Government to see if there is some other agency which had the necessary personnel, equipment, and facilities to perform this job. If they find such an agency, they should then transfer the necessary authorization and funds to the second agency to do the work for them. This requires no red tape to speak of, and no congressional approval.

From this, the National Bureau of Standards has grown and thrived because over 60%, and some years ago it was as high as 80%, of all of our work is not paid for by direct congressional appropriation, but by transfer of funds from other government agencies to do specific jobs for them.

This "transfer work" is the major function of the National Bureau of Standards insofar as its work load is concerned. Testing standards and calibration amount to not more than 10 or 15% of our work. What the public receives indirectly are publications derived from the work for the Quartermaster Corps, the Federal Trade Commission and Post Office De-

partment, and many other agencies developing new types of materials, making tests for them or carrying out research problems for them, because these agencies may not have well-equipped laboratories with competent personnel able to do this in a quick and expeditious fashion, nor able to provide the desired answers.

So Mr Appel's largest problem is to provide to other government agencies the services which they need and require in their operation. This really is an "economy act" from the standpoint of the government because it just wouldn't pay each Federal agency to establish a laboratory of technology. We are essentially the National Physical Laboratory of the United States and in this we provide service to Government agencies. This doesn't preclude the contracting to universities or industries or to private corporations and research foundations, of specialized services. Many of our jobs are of the quick-information type, which would not be considered a desirable type outside the government.

We make tests for the Federal Trade Commission upon battery additives and various things of this sort. We make tests for the Justice Department, and many of these tests involve legal cases where it is necessary for the government to make sure it is right; if they are not right, we have to be sure that this information doesn't leak out and cause mistakes and injustice. Many of the jobs are classified in this sense, and because the Bureau has a well screened group of employees whose loyalty has been verified, it is possible to initiate these very rapidly and get such tests completed.

Actually, the advisory services which we provide go a great deal further than just the advisory services to the Federal agencies. It goes beyond the Federal agencies to science, technology and industry, and here again the Bureau plays a very important part in the nation's scientific development program. There are over 400 committee memberships held by Bureau employees in the American Society for Testing Materials. Mr Appel is chairman of ASTM Committee D-13 on Textiles, and he serves on several other committees of the Society.

The American Standards Association takes a very active role, and in this also, Mr Appel has taken a very active part. He is chairman of the L-23 Committee and also a member of L-12 and L-14 committees, all of them dealing with standards, the first of these on international standards. His activity in international standards has been demonstrated by his membership on delegations to the International Organization for Standardization on Textile Nomenclature and Textile Properties. In 1951 he served as a chairman of the American delegation in this area.

I think I need not detail his AATCC activities, which have reached the very peak. You have honored him both by election and by honorary medal confe. ment. His service as the president of this organization, of course, is well known to you. He has also served for many years as a member of the Research Committee of this organization.

He has served the American Chemical Society for many years as chairman of its Dye Division. ACS, considering him as one of their own, has honored him with a front-page portrait in their official journal in recognition of the conferring of the Olney Medal to him on this occasion.

In Mr Appel's group in the National Bureau of Standards, which isn't very large, and I think many of you will be surprised at how small the Bureau is, considering the many areas in which we deal, there is only a very small segment in textiles, just as there is a very small section in paper, and in leather and in glass and other commercial interests. These small sections or segments of the Bureau serve as liaison units between industry and other areas of the Bureau, while providing the government with services in these areas. They also serve as a training school, one might say, of which I am proud to be a graduate. Milton Harris, one of your former Olney medalists, is one of the graduates of this same area of the Bureau. We are proud of the number of people who have served at the National Bureau of Standards in part of their technical career.

In addition to being a training school for individuals, it is a training school for organizations. We are proud that the National Bureau of Standards is the birthplace of the Atomic Energy Commission.

When President F D Roosevelt, upon the urging of distinguished scientists, decided that there might be something in atomic energy, he transmitted to Dr Briggs, then NBS director, the request that he get together a small group and spend some $6000-7000 in investigating its possibilities.

Later on we spent a hundred thousand, and still later, it got so big they finally decided that they would remove or take this particular thing out of the National Bureau of Standards and make a Manhattan District out of it.

The first six months' work on the atomic bomb was done at the National Bureau of Standards. This is not the only large organization which would completely swamp the parent if it were still a part of the Bureau. Such organizations as the National Advisory Committee for Aeronautics and the Naval Research Laboratory started in the National Bureau of Standards.

Just recently there was cleaved from the Bureau a large ordnance laboratory which is as large as the whole Bureau and which was just beginning to swamp us a little bit. Now we have cut back to size. They gave us a 25% cut, but this is a matter which we hope to remedy, because we actually have not kept up with the growth of science and demand.

Our present technical staff is of the same size, relative to the standpoint of commodity, as we were in 1938, and this has not kept up with the growth of science and technology, and, I am sure, your own demands for services.

Actually both the president and the director of the Bureau of the Budget have recommended to Congress that the National Bureau of Standards be expanded to a reasonable degree, perhaps to about 40%, which would be applied to the textile area just as well as to any other area of the Bureau.

Within the Textile Group, the Textile Foundation owes its original housing and accommodations to the Bureau, prior to its cleavage from this area. In fact, two separate organizations were formed at that time because Harris, who was with this group, also established his laboratories.

We also feel we are the godfathers to the National Institute of Drycleaning, which, like many organizations that have cleaved from the Bureau, started as a research associate. Upon realizing the effectiveness of a collaborative, scientific reference laboratory they established their own laboratory.

Bill Appel has been for many years a strong supporter of scientific and technological institutions. His original education and training was in biology, zoology in particular, and chemistry. He is a most unusual scholar in having this broad, dual background.

In fact, one organization to which he belongs now claims him as a 50-year member. This is in the Washington Biologists Field Club, which he joined at a rather early age. In many organizations, however, he maintains 30 and 40-year memberships, including the AATCC.

He has been honored by the Department of Commerce, which presented to him its highest award, the Exceptional Service Gold Medal, and by the Lowell Technological Institute, which conferred upon him an honorary degree and the honorary title of professor.

I think, among the various honors and awards which he has received, probably that of the Silver Beaver of the Boy Scouts of America is the one which he cherishes most because he has been a public citizen. He has demonstrated his interest in human life and activity through this. As a matter of fact, if any

person applying to the National Bureau of Standards can present a letter saying they were a member of Bill Appel's Boy Scout Troop, this is the only recommendation they need, in our opinion.

I might say that, if any girls join our staff, all they need is a recommendation from Mrs Appel, who is as active in the Girl Scouts as her husband is in the Boy Scouts. Between the two of them, they have demonstrated a most distinguished service career, both to science and to public service. I am very pleased to be here today to extend my congratulations to both the American Association of Textile Chemists and Colorists for having such a distinguished member, and to Bill Appel himself.

Thank you.

* * *

*Samuel L. Hayes:* There is a temptation on my part not to say, "Thank you, Dr Brode," but to say, to him, "Doctor, you are welcome."

Because of his association and because of his affection for Bill Appel, I know he was sincere when he told me that he thanked us for inviting him here, and when he expressed to us his pleasure at being here.

I believe Dr Brode is now a member of the AATCC, and Doctor, we look forward to your attendance and participation in our future conventions.

There have been many times during the last two years when I have sat in meetings of various types with our president, Bob Bonnar, and many times when there was some difficult decision to be made, when things perhaps were going crosswise, and many times I have said to myself, "Sam Hayes, you are lucky you are not president of the AATCC."

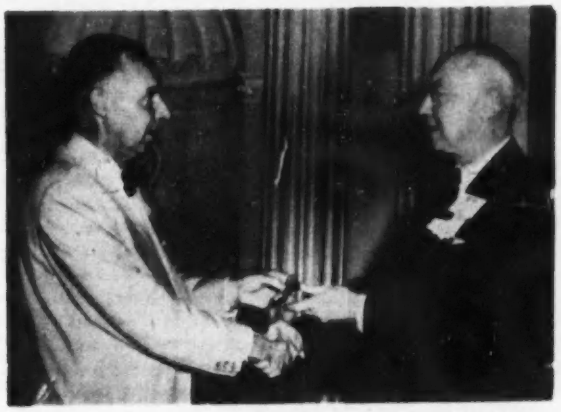
But coupled with that part of his job, there have been some pleasant tasks, and as of today I am very jealous of Bob Bonnar. Would I were now president of the AATCC! Would that I would now have the honor of presenting the medal to Bill Appel. But that is a prerogative of your president, and it gives me a great deal of pleasure to introduce to you Bob Bonnar.

* * *

*J Robert Bonnar:* Thank you, Sam. You can see why he is such damn tough competition. He almost makes me believe I am doing a good job myself.

I am not going to make a speech. This isn't the time to make a speech, and you all have seen me a good many times anyway.

I did have two or three things that I wanted to say. It is very disconcerting to have only three things, and then have one of them stolen from you, which is what has happened today, but I am going to say it anyway.



**President J Robert Bonnar (left) presenting the 1954 Olney Medal to William D Appel**

I was going to say that Bill Appel, every time we see him, every time we hear him, every time he does anything for AATCC, or any other organization, gives us a charge, and I was therefore going to suggest to the Bureau that they might like to transfer the Battery Testing Division to him, but that thought was stolen a little bit, so it goes a little flat.

We are very pleased and glad that the Howes Publishing Company, Inc, in 1944 afforded us the opportunity of having an Olney Medal Award.

The first one, as you know, went to Dr Olney himself. It was very timely and it was well deserved.

The rest of the recipients also have been very fine contributors, not only to our own organization but to other organizations in the textile industry as well.

We have mixed feelings about this. We have so many people to whom we would like to give the medal, that we could almost give one a week, and yet the other side of that feeling is that if we did, it would lose its importance, and I am glad to say that each and every recipient up until now and including Bill, who is to receive the medal today, has been one of those cases where we'd like to say there is only one in 50 or 100 years, it was so important that each be recognized.

Last year I told Mrs Derby that I felt she'd had a part in Roland's receiving the medal.

I think all wives do. I am going to go a little bit beyond that today though. I am going to say that I think the very analytical way, the very slow, careful, methodical, meticulous way in which Bill tackles a problem has been instilled into him a little bit by someone over and beyond the ones who have been mentioned today, even Mrs Appel.

I think collecting those match covers as he did for many years for his mother-in-law was excellent training for him — perhaps he has stopped now, but he was always going around and saying, "I don't think we have that one."

I think it made him "look into all corners" on any problem. He's done a very fine job. It therefore gives me a great deal of pleasure personally, because I have known him for many years too, to offer him the opportunity of receiving this medal, and I am pleased now, as the representative of every member of this association, to give him the Olney Medal.

**The Olney Medal**

# ADDRESS OF THE MEDALIST

## WILLIAM D APPEL

*William D Appel:* President Bonnar, Chairman Hayes, Dr Brode, guests and members of the AATCC:

Thank you!

I appreciate this great honor and am grateful to the members of the Award Committee. I know, and the Committee knows, that any contribution of mine has resulted from collaboration with others, many of them in the AATCC or the National Bureau of Standards. The award reflects their efforts as well as mine and my appreciation is all the greater because it gives me this opportunity to publicly acknowledge their share in the honor and my indebtedness to them.

I thank Dr Brode for speaking here. As you have been told, he was co-author of my first paper published just 30 years ago. The paper was on spectrophotometric analysis of the dye Chromotrope 10B. Dr Brode will remember very well the slow, tedious work necessary when automatic recording instruments were not yet developed. Dr Brode has continued his spectrophotometric investigations and he is today a leading authority in this field.

A special word of appreciation is due President Bonnar, my friend and mentor for years. Always calm and understanding, he has helped me and the Association deal with many difficult problems. It is a particular pleasure, Bob, to receive the award from you.

Several of you have asked how I became interested in the Association. Well, my work at the National Bureau of Standards was on the standardization of dyes. It had been started at the request of the industry because of the chaotic conditions following World War I. Soon, however, the dye manufacturers undertook to correct the situation without Government help. Our Advisory Committee from the American Chemical Society advised the Bureau to develop colorfastness test methods and my program was changed accordingly.

Dr Olney, in whose honor the Olney Medal is given, had an important part in this decision. He was a member, I think chairman, of the ACS Committee. He was, as you know, president of the AATCC and chairman of its newly formed Research Committee. Through him I became a member of the Research Committee in 1923.

In the early years I worked intimately with some of the great leaders of the Association; with Dr Olney, of course; with Will Cady on colorfastness to light; with Hugh Christison on colorfastness to laundering; with Walter Scott, Harold Leitch, William Moorhouse. Later on, I worked with Milton Harris, Harold Chase, Roland Derby, Dan Knowland, Walter Durfee, Charlie Seibert. The list is far too long to name them all.

You know these men and the work they have done for the Association and the industry. You know the many others who occupy responsible positions in the Association: Harold Chapin, Al Sampson, Sam Hayes, Leonard Little, Charlie Dorn, Harold Stiegler —— to name only a few. It is a rewarding experience to know these men intimately, to work with them, depend on them, develop a respect for them, and, as time goes on, develop a deep affection for them. That has been my experience in AATCC. The great strength of our association lies in these personal relations and in working together on problems of common interest.

Now, I am aware that something more than "thank you" is expected of me at this time, that the award should somehow endow its recipient with scintillating wisdom and a fluent tongue with which to share it. I have received the medal, but not the endowment!

There are two lines of thought that seem appropriate because they concern the research program of the Association and the Corporate members who are our guests today.

With the support of the Corporate members the research program of the Association has made a very substantial, indeed essential, contribution to the textile industry. Starting with a few simple test methods lacking in duplicability and bearing little relation to performance of the products in use, the Association has created an extensive series of standard test methods, testing machines, and materials for use in testing. These standards have helped dye manufacturers to produce better products and to sell them. They have helped textile dyers, printers, and finishers. They have helped distributors and users of textiles. They provide a common language understood by all of these groups.

It is important to note that these standard test methods are not specifications. They do not set limits on what a producer may make. They are means for describing materials with respect to colorfastness and other properties wherever they may fall on the scale from fast to fugitive, high to low.

These methods have wide acceptance. They are used extensively. They have been adopted by other organizations concerned with textiles, the American Society for Testing Materials, the American Standards Association, and the Federal Government. Thus, the AATCC has become the authoritative source for such methods.

This leadership carries with it grave responsibilities. First, it carries the responsibility to make the methods the best that can be devised, and second, the responsibility to anticipate the needs of the industry for reliable test methods. Failure to anticipate needs may lead to serious problems for the industry. Thus the Flammable Fabrics Act that became effective July 1 was possible because the Association was able to provide an acceptable test method. Without the method, makeshift legislation probably would have been enacted in the individual states, legislation differing from one state to another and creating an impossible situation from the viewpoint of marketing. Those affected will agree that the law would have been still better if the AATCC had done more work on the flammable characteristics of a greater variety of fabrics and had provided an even better method for distinguishing different types and degrees of flammability.

It is clear that the Association must increase its efforts to provide new and better test methods to meet the growing needs.

My second train of thought relates to the work of the Technical Committee on Textiles (TC 38) of the International Organization for Standardization (ISO). This committee has been working since 1948 toward the coordination and unification of the textile testing methods and standards of the member countries as a basis for a common understanding among producers, distributors, and users of dyes, finishing materials and processes, and textile products. The need for standard test methods is just as great on an international scale as on a national scale, and the arguments for participating in the work are similar. At present 35 countries are participating in the work. U S participation is through the American Standards Association.

The AATCC is playing an important part in ISO work on methods for testing colorfastness and methods for testing shrinkage in laundering. At meetings in Scarborough, England in June of this year devoted exclusively to these subjects 41 top technologists from 13 countries participated. The American delegation of 6 was led by Leonard Little, chairman of our Executive Committee on Research. Methods for testing colorfastness to 24 different color-destroying agents were agreed upon by the ISO Subcommittee and 13 other methods were accepted tentatively pending trials of them in interested

countries. After favorable action by TC 38, the methods will be ready for adoption as "ISO Recommendations." The ultimate goal, recognition of the methods as international standards, requires approval of all member countries.

A number of AATCC methods were adopted in spite of the fact that their use will make it necessary for laboratories in some countries to provide new equipment. Without U S participation, the methods agreed upon probably would have followed European practices, which differ from ours, with the obvious complications in international trade. This extension of the work of AATCC deserves your support.

Other subjects of wide interest to the U S textile industry are under consideration in ISO/TC 38. Some of them may seem impractical or academic, but they are directed toward simplification and economies through improvements in practices that probably are becoming outmoded by changes in the industry. For example, a single universal system for designating the "number" or weight-length relations of yarns of all kinds has been agreed upon to replace the numerous systems now used. This direct, decimal system is finding some use abroad. It has an appeal to those who deal with more than one kind of yarn.

Another example is the proposal to recognize a comprehensive series of "preferred" numbers, or sizes of yarns and discourage production of other sizes except on special order. This proposal would give the industry the well-known benefits of simplification through the reduction of unnecessary variety.

A third example of what may appear to be a long range project is the proposal to recommend marketing all fibers on a zero regain basis instead of the present multiplicity of commercial regains.

The American industry should consider these proposals seriously, discuss their advantages and disadvantages, and send delegates to the international meetings to present their views.

Other important subjects under study in ISO/TC 38 are: general methods for testing fibers, yarns, and fabrics; methods of measuring cloth width, length, thickness, and weight; standards for humidity, temperature, and conditioning; and standard definitions and nomenclature.

You know better than I do the growing importance of international trade in textiles to nearly every branch of the U S industry. Our industry should take part in the ISO work to a greater extent. Further information about the work may be obtained from the American Standards Association in New York.

Mr Chairman, again let me say a very sincere and heartfelt thank you.

* * *

*Samuel L. Hayes:* We have certainly added another worthy name to the list of those who have received the Olney Medal Award, and I am particularly pleased that I had a part in this meeting today.

In casting about trying to decide what I would say to Bill when he was finished with his talk, I ran across a little poem from which I would like to quote:

"Scientists will praise your name
For ably representing them
But we who know you, shall remember
Your smile, serenely warm that you
Bestow on all you meet. Smiles say
Far more than words may signify, for
Words appeal to mind, while smiles
Like yours touch human hearts."

And I could not let this meeting end without making note of that very human aspect that goes with Bill's life, and so, Bill, while in 1924 you may have written on Chromotrope Red 10B and in 1925 on Agalma Black, there are many of us who shall remember your smile, "for smiles like yours touch human hearts."

## *Annual Banquet*——

*(Concluded from page P10)*

Following Mr Foster's "address", Toastmaster Harris presented past president C Norris Rabold.

### PRESENTATION OF THE PAST PRESIDENT'S PIN

*C Norris Rabold:* Some of you will remember a famous speech from Shakespeare's "Julius Caesar."

It begins something like this:

"Friends, Romans, countrymen, I am here to bury Caesar, not to praise him."

What I am here for tonight, ladies and gentlemen, is to honor our president, not to consign him to oblivion. You have all heard of a little item that some of us have the privilege of wearing very proudly. You can see it here on my lapel. Intrinsically it is not of great value, and I doubt seriously, if we got into bad financial straits, that we could get very much gravy and grits for it.

That is not the point, Bob. You know about the pin. All of you know about it, for it is the pin of a past president. To date there are only 11 presidents of this association who have had the pleasure and privilege of wearing this little pin.

Bob, you know how we past presidents feel about our pins. You are going to be the twelfth member of this association who has the right to wear it. I know you will wear it with the same feeling of pride as do the rest of us.

Ladies and gentlemen, I am not here to eulogize Bob. I have known him for well over 20 years. Some of you have known him longer, some of you less long, but we all know what Bob has done for this association. As he said himself, he's been active for 27 years. His advice and counsel have always been welcome, and many of us have profited by it in our association activities. He was the second chairman of the Executive Committee on Research, helped to found it, and helped to organize it.

The job of serving on committees and the job of being president are onerous tasks, I can tell you. Many's the time we frequented the well-known smoke-filled rooms until the wee hours trying to thrash out problems. In fact, I have smoked second-hand some of Bob's smoke in those rooms for many hours, or I smoked his second-hand cigars, I am not sure which.

Right now, Bob, on the page labeled "Organization" in our *Year Book*, your name is up there in great big letters ———J Robert Bonnar, president. Down at the bottom of that same page in very much smaller letters, there is a group of names entitled, "Past Presidents." Very shortly you are going to be one of those. That doesn't mean that you are passing into oblivion. That means merely that you are continuing your activities in the Association as one of the honored and distinguished members of this small group at the bottom of the page.

While I was talking to Bob the other day about the presentation of the pin, he said rather modestly, "Well, don't make any fuss about it. When you get up there at the banquet, just take the pin and stick it on me."

Bob, if you will stand up, without the smoke, I am honored to stick it on.

(President Bonnar received a standing ovation from the audience as Mr Rabold presented him with the past president's pin.)

* * * *

The Banquet was concluded with a program of professional entertainment and an invitation to attend the 1955 Convention at Atlantic City, N J.

*Contribution*——

# SEVENTY YEARS OF COLORIMETRY*

G J CHAMBERLIN

*The Tintometer Limited, Salisbury, England*

**An English visitor presents to American readers the true story of how a poor boy, J W Lovibond, came to invent a brown glass color scale for measuring the color of beers. The pressure of public interest led Lovibond to develop his full system of glasses consisting of three series of primary subtractive colors. This pioneer in color measurement insisted that color is subjective and is best described by "what it looks like to an observer". The matching of colors with Lovibond glasses is then relatively free from metamerism, that is, the phenomenon by which colors may match in one illuminant but not in another.**

**The Lovibond system of color measurement is related by the author in a simplified nonmathematical manner to the CIE (international) system of color transformation. He also describes how a modified Lovibond Tintometer can be employed to interconvert instantly between Lovibond glasses and Judd's uniform chromaticity scale. Some interesting new applications of visual color measurement are made to scientific and commercial problems.**

## INTRODUCTION

THE United States has many impressive stories on the old theme "Local boy makes good", but so has England, and one of these concerns a pioneer in the science of color measurement. This paper tells his story, and describes the contributions to colorimetry which have resulted from his work.

## J W LOVIBOND, 1833-1917

Joseph W Lovibond was born 121 years ago in Somerset, England, the son of a barge-owner who carried freight on the canals. His mother died when he was 5, and an unsympathetic stepmother drove him from home. At 12 he sailed in an old windjammer to Australia, but jumped ship when he got there because he did not like the captain, and joined the gold prospectors at Ballarat. He soon heard the stories of goldmining in America, and worked his passage there in sailing ships. At the age of 16 he was taking part in the California Gold Rush of '49, but 5 years later he was back in England with all his money gone. He joined his father in starting a brewery in London, and when he was 36 moved to Salisbury, Wiltshire, to open a brewing business of his own.

BEER COLORS———As a brewer, he felt the need of keeping a record of the color of his products, so that he could relate color to quality and flavor. After unavailing attempts to keep samples of beer and then of colored liquids, he arrived at the logical answer that the only absolutely permanent record he could keep of what his beer looked like was in terms of selected pieces of brown glass. After much search he obtained a set of such pieces which were the color of his malt worts and which increased in depth of color by approximately equal increments. His enthusiasm led him to read a paper to the British Institute of Brewing, and soon he was flooded with requests from other brewers to let them have some of his glasses. Thus was the Lovibond Brown "Series 52" born.

The next step was the realization that color is three dimensional, possessing *hue*, namely, "what kind of color"; *saturation* (chroma), namely, "what strength of that color"; and *brightness* (luminance, value), which is frequently equated with the black-to-white scale but which can, in everyday usage, be visualized as "how brilliant or dull it is".

THREE PRIMARIES——— Lovibond soon found how difficult it was to match his beers on a one-dimensional color scale, because their colors varied in three dimensions, as will any natural product. This, together with a growing demand from all around the world for scales of color for other commodities, led him to tackle subtractive colorimetry using three primaries—*red*, *yellow* and *blue* as he called them, but *magenta*, *yellow* and *cyan* as they are more correctly termed today.

He obtained ranges of glasses (of a convenient size for handling) in these three colors, which increased in very small equal steps, and so chose them that equal unit values of the three colors always combined to produce a neutral tint. With this tool of infinite flexibility, he could match any color in all three dimensions at once. With about 200 steps in each of the three colors, it was his proud boast that he could produce over six million possible combinations.

Just about 70 years ago he was thus launched into producing instruments incorporating these glasses, so that an operator could record and describe any color in terms of these "Lovibond Colour Units", and before the end of the last century these Lovibond units had received international recognition in the brewing, leather, and petroleum worlds, and he had produced equipment suitable for using these glass scales for measuring the color of transparencies, surface colors and light sources.

He was twice mayor of Salisbury, and remained very active to a great age, and rode to a meet of the local foxhounds on his 80th birthday. During World War I he did much research on camoflage for the British Admiralty. He died in 1917.

## GENERAL DISCUSSION

APPLICATIONS———Lovibond's glasses were used by the American Geological Survey before 1900, and by 1912 these glasses were in wide use in the USA in the oil industry. In 1913 the late Irwin G Priest of the US National Bureau of Standards led a discussion on them at the 4th General Meeting of the Society of Cotton Producers. In 1927 Gibson and Harris issued the famous Bureau of Standards report, "The Lovibond Colour System" which introduced the "N" scale, and while this was in some ways critical, Priest in the introduction paid high tribute to the work of Lovibond and the value of his system. Perhaps Lovibond's greatest contribution to the subject, which today is sometimes lost sight of, is his emphasis on the fact that color is a subjective sensation which has no meaning without an observer. This has been put into a slogan "If you want to know what a color looks like—look at it". The electronic measurement of the stimuli producing a color is a perfectly correct and valuable procedure, but it is not *the measurement of a color*, which is a visual sensation. It produces valid information, but does not convey

* A contribution rec'd by the Editor of AATCC Proceedings on July 18, 1954 and by Am Dyestuff Reptr on Aug 30, 1954.

to the reader what kind of color is being discussed.

In commerce what is wanted is a clear statement, in terms that can easily be visualized, of "what does this color look like to an average person". The simple way to produce such a statement is

1) Look at it.

2) Compare it visually with some permanent, reproducible, and adequately variable scale under properly controlled conditions.

3) Record exactly what was done, so that a sample of the color can be immediately and exactly reproduced from this record for anyone else to see.

There are a number of visual systems satisfying these conditions, such as the Munsell Atlas, trichromatic additive colorimeters and the Lovibond Tintometer. The latter has the great merits of extreme simplicity, permanence, and robustness, and, as has often been pointed out by both Judd *(1)* and Wright *(2)*, subtractive colorimetry suffers less from difficulties of metamerism than additive colorimetry, as a much nearer energy match is obtained.

Lovibond units are now quoted in official color specifications by 20 different nations, and this list is constantly growing.

CIE ——— In 1931, the Commission Internationale de l'Eclairage formulated a mathematical background for colorimetry, based on the work of Guild and Wright in England and D B Judd in the USA, and this enabled conversions of color readings to be made from one system to another.

Much has been written to explain and popularize this CIE system, but nearly always it has been framed in such mathematical terms that nonmathematicians have found themselves unable to follow it. The present author made an endeavor to explain the principles without using mathematical formulae, and this little book has certainly met with a most encouraging welcome *(3)*.

The approach to this problem, put into the very briefest possible form, is to imagine the color triangle as an equilateral triangle with three beams of light, red, green and blue-violet, shining inwards towards the center, one from each point of the triangle.

These lights are so arranged that the red, for instance, is at full power at one point of the triangle and is reduced uniformly until it has been reduced to zero at the opposite side. Similarly with the other two colors, so that, along any side of the triangle, colors are produced that are a simple mixture of the two colors, which are at each end of the side, and the light shining from the opposite point has no part in the mixture at all.

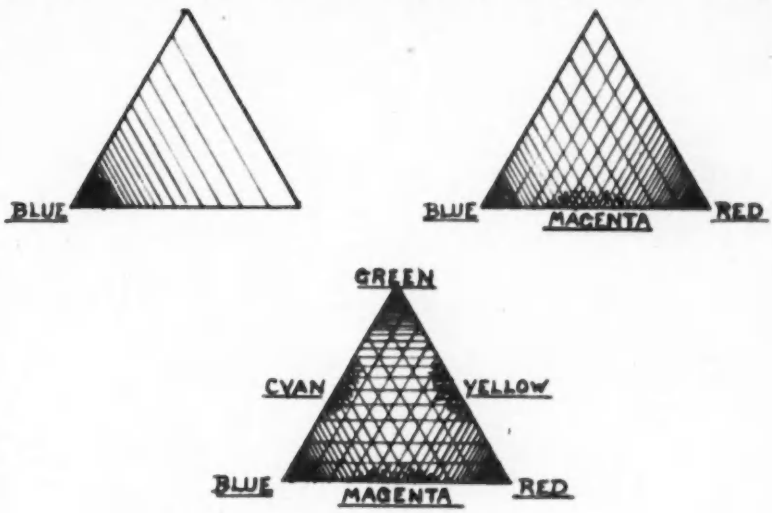



**Figure 1**
**Experimental Approach to the Color Triangle**

As one's gaze moves from any side of the triangle inwards in a perpendicular direction towards the opposite point, this third color exerts an increasing influence. The choice of these three colors and their luminance is such that they combine at the central point of the triangle to produce white. Thus, within this triangle, any color quality can be found: the more saturated colors on the perimeter of the triangle and the desaturated colors in the interior.

Although spectrum colors are used for the three primary colors, it is found that the intermediate colors lying on the perimeter of the triangle are not fully saturated spectrum colors, although they exhibit a very wide chromatic range. The positions of the true spectrum colors fall outside this triangle except at the three points chosen, and it has been necessary to work with these "supersaturated imaginary colors", or stimuli, designated X, Y and Z, which form a triangle outside this original above-described triangle, and enclose the whole of the path traced by actual spectrum colors.

Within the XYZ triangle any color can be designated by describing its exact position, and this is done by means of geometrical co-ordinates. Thus, the xyz trichromatic coefficients may be imagined not as colors themselves, but as distances within the triangle which fix the position

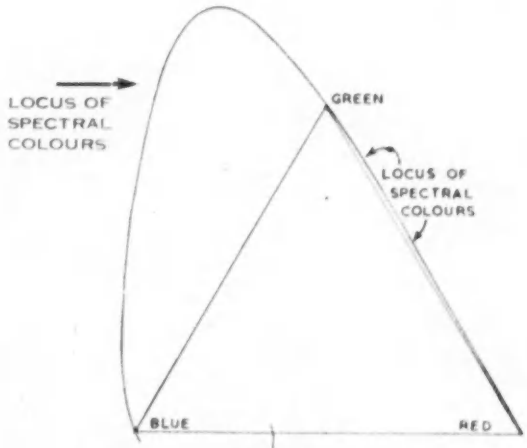



**Figure 2**
**Diagramatic Representation of Spectral Colors**

The spectral locus marks the position of the points which represent the pure colors of the spectrum in relation to the arbitrary triangle that has been adopted

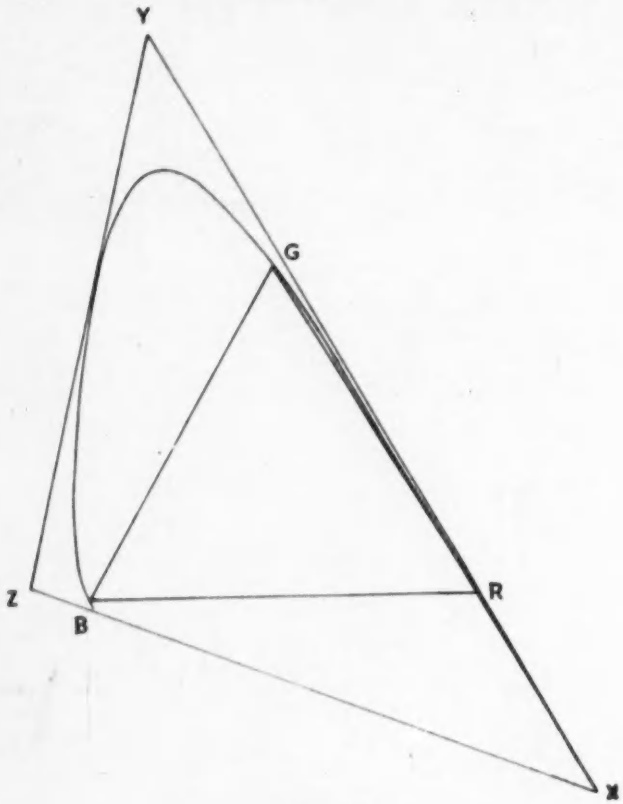



**Figure 3**

**Diagrammatic Representation of the Reference Stimuli X, Y, Z**

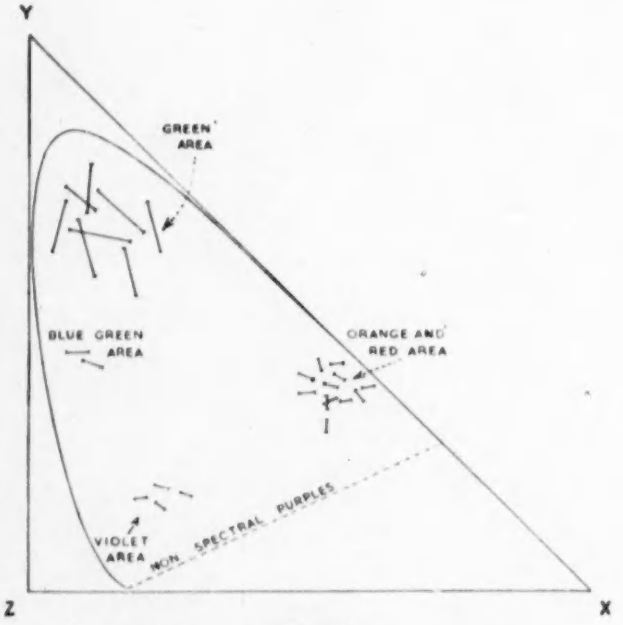



**Figure 4**

**Lines Showing Equal Steps of Color Difference on CIE Chromaticity Triangle**

of a given point. The CIE system finally ties up with the visual appearance of a color because it fully defines the viewing conditions (illumination etc) and makes due allowance for the reactions of the eye and brain through the conception of a defined "standard observer".

EQUAL CHROMATICITY DIAGRAMS ——— Unfortunately, equal distances in this triangle do not represent equal color differences.

In 1935 Judd suggested a special transformation of this figure to produce an equal chromaticity figure, in which equal distances (in most areas) represent equal visual color steps.

Under the supervision of Dr R K Schofield of the Rothamsted Research Station in England, a modified design of the Lovibond Tintometer was produced to simplify the conversion between the Lovibond and the CIE systems. A photometric device controls the brightness of the illumination falling on the sample relative to that falling on the white comparison surface, and the color matching is then reduced to the two-dimensional adjustment of hue and saturation (chroma). This is done by using glasses of only two colors at a time. It is then possible to plot all color-quality combinations of Lovibond glasses on Judd's two-dimensional graph, and thus not only to interconvert instantly between CIE chromaticity coefficients and Lovibond values, but also to see at a glance the relative color-quality differences between two colors and their distance from one another in terms of easily perceptible differences.

THE SIGNIFICANCE OF COLOR-READING DIFFERENCES ——— The foregoing leads to a useful way of explaining the difficulty found by some people in reconciling differences in color readings obtained by different observers who possess normal color vision. No sensitive instrument can produce absolute answers, but all work to a stated tolerance. A schoolboy's ruler will pronounce a piece of wood to be exactly 1" thick, while a micrometer screw gauge says it is less or more than 1" by several thousandths. So with colors, a proper sense of proportion must be maintained. It is pointless aiming to work to several places of decimals when they have no significance. By means of this equal chromaticity chart it is possible to see whether a discrepancy really matters or not, in terms of visual differences. The eye, for instance, is much less sensitive to changes in yellow than it is to red or blue.

If a selection of the Lovibond yellow scale is looked at when displayed as a series of equal Lovibond unit increases in color, the steps appear to become smaller visually as the saturation increases.

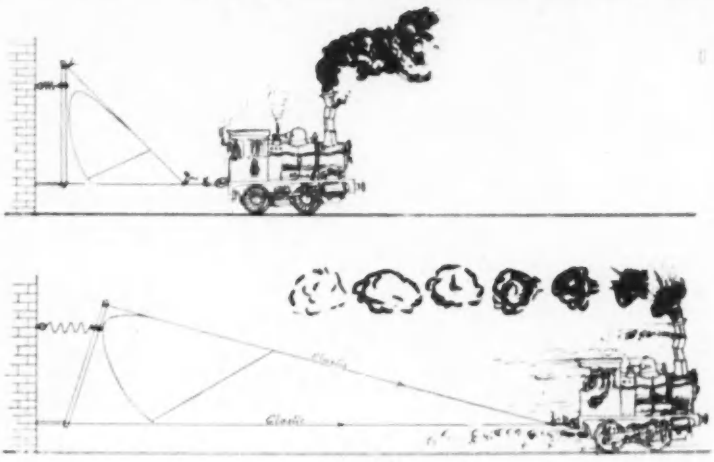


**Figure 5**
**Equal Chromaticity Triangle**
A somewhat frivolous representation of how the rectangular plot of the CIE triangle has been transformed to produce an equal chromaticity triangle.

a big overlap, and a study of the transmission curve shows that above 70.0 units all the blue is cut out, and further additions cannot contribute anything further in "yellowness". They merely cut down total transmission and produce a dulling effect. The use of very high Lovibond-yellow readings is therefore not good practice.

## NEW APPLICATIONS OF VISUAL COLOR MEASUREMENT

The uses of visual color measurement which Lovibond knew are still with us and have grown to embrace the whole world, but it is the phenomenal growth of entirely new applications that makes our work so interesting.

A number of the leading art galleries of the world have found that Lovibond has given them a tool with which they can better understand and protect their treasures.

Through the medium of colorimetric chemical analytical techniques, a complete range of color standards has been prepared covering hundreds of different chemical and medical tests, and the Tintometer Company is co-operating with the United Nations Health Organization in a number of ways by providing control equipment to help diagnose and fight disease and also to assist in such new tasks as tracking drug smugglers. Lovi-

*(Concluded on page P28)*

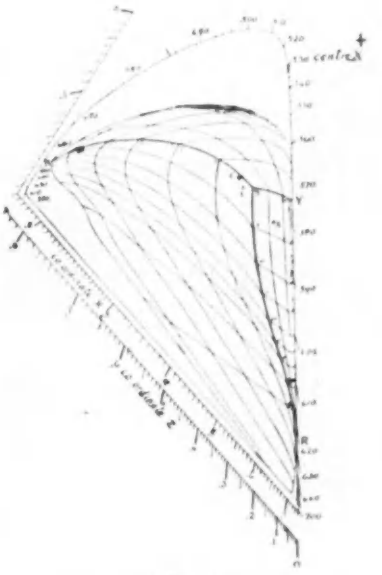


**Figure 6**
**Nomogram on the equal chromaticity projection for converting Lovibond chromaticities into CIE values**

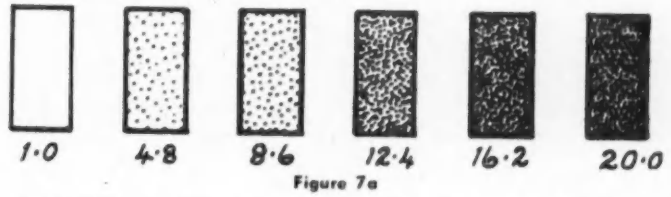



**Figure 7a**

Lovibond yellow values 1.0 - 20.0 in steps of 3.8 units representing equal increments of the same yellow color.

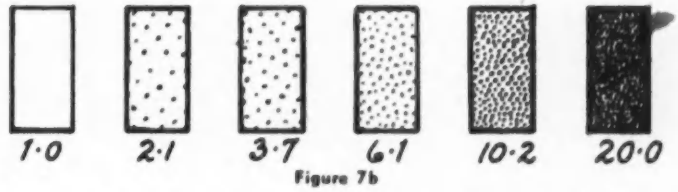



**Figure 7b**

Lovibond yellow values 1.0 - 20.0 representing uniform visual color increases as interpreted by the Judd uniform-chromaticity scale.

*Note:* Much bigger increases are necessary in the higher values to produce an equal noticeable change of color to an observer.

If now a fresh range of these glasses is displayed, set out to show equal perceptible differences of color as read from the Judd scale, it will be seen that, as the saturation (chroma) increases, the steps in terms of Lovibond units increase in size. (Figure 7b).

Hence, differences of reading in the lower part of the scale are likely to mean that someone is doing careless work, while the same Lovibond unit differences in darker colors are quite without significance. The amount of discrepancy which matters cannot be expressed as a percentage, because the visual significance varies between colors and between different saturations. A true assessment of the importance of a color-value discrepancy can easily be obtained, however, in terms of perceptible differences by reference to a chart such as this of Judd's.

HIGH-YELLOW READINGS ——— A point worth mentioning is the use of very high yellow values in the oil industry. To work as subtractive primaries, the three ranges of color glasses must have very wide transmission bands with

*Mid-West Section——*

# THE DYEABILITY OF MODERN SYNTHETICS*

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## INTRODUCTION

I READ the other day something I should have known long ago, that on the facade of the National Archives Building in Washington there is inscribed in big letters, "What is past is prologue."

This reminds me of the taxi driver who, after calling the attention of his passenger to the inscription, said: "You know what that means? It means you ain't seen nothing yet!"

This taxi driver's terse expression applies indeed to the development of modern synthetic yarns and fabrics. We have come a long way from viscose, the first fragile yarn ever made by man, to the toughest of all fibers, the polyamides. The end is certainly not yet in sight; and each new fiber brings a new problem of dyeing.

I do not intend to talk about or review all phases of the dyeing of our modern fabrics. As such a review would take much more time than we can presently afford, I shall limit my remarks to the high points of current knowledge with respect to those aspects of dyeability that are now well known and particularly striking.

I have often heard that cotton, wool and silk represent man's best fibers. They are comfortable fibers, lending themselves readily to standards in finishing. The modern trend and intent is to retain all the good properties of these natural fibers and to supplement them with the desirable properties of man-made fibers, such as tenacity, toughness, dimensional stability to wet and dry cleaning, ability to be set by heat, resistance to abrasion, heat, sunlight, climatic conditions, acid, alkali, chemicals in general, and bacterial, moth and mildew degradations. The intent to achieve a fiber with all these qualities is of course very ambitious; yet, the progress already realized in recent developments promises to be only the prologue of greater accomplishments to come (*1*).

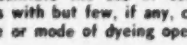
Tonight I plan to review primarily one phase of these developments, namely, the dyeing of modern polymeric fibers with emphasis on *acid dyes*.

**Conditioning by boiling off, scouring and bleaching and such physical properties as moisture regain and absorption, wetting and swelling have long been associated with the dyeing of fibers and, in one phase or another, have been considered as primary factors in the fixation of dyes. The advent of the modern hydrophobic synthetics has modified such concepts and has demanded complete changes in dyeing techniques. With the latter have come the introduction of high-temperature processing (wet or dry), pressure dyeing and the use of carriers, often with colorants of entirely new structure or with the creation, within the fibers, of dyeing sites, which facilitate the use of conventional dyestuffs with but few, if any, changes in structure or mode of dyeing operation.**

## STRUCTURAL DIFFERENCES BETWEEN WOOL AND POLYMERIC FIBERS

Most of you are familiar with the structural presentation of wool by Astbury and Speakman (see Figure 1).

Let me point out that the amino acids (of which more than 18 different types have been identified by Harris) form long polypeptide chains, in which the recurring groups are



The amino acids are attached to these long chains in the form of side chains. The long polypeptide chains are linked together by bridges:

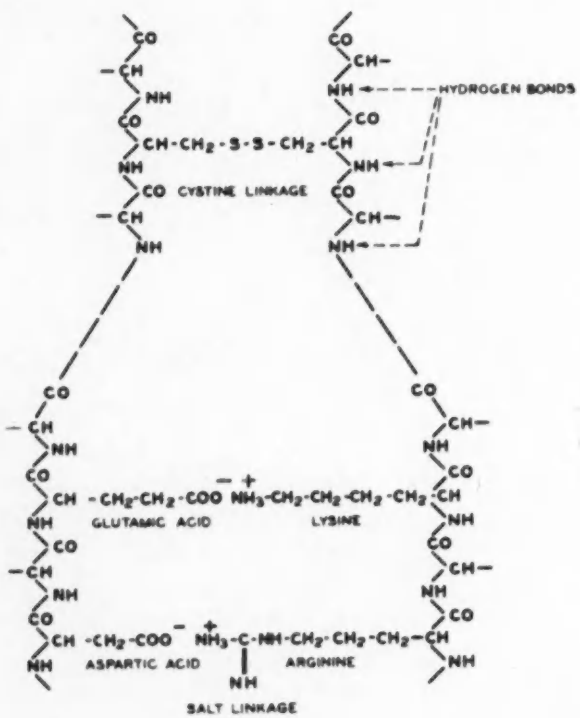



**Figure 1**
**Schematic Wool Structure**
Astbury & Speakman

* Presented at the Netherlands Plaza Hotel in Cincinnati, O, on April 10, 1954. The ms was received by the Editor of Proceedings on July 1, 1954, and by Am Dyestuff Reptr on Aug 24, 1954.

a) cystine bridges, which give the wool fiber its mechanical strength and lateral resistance;

b) salt linkages, which lend the fiber its tinctorial properties; and

c) the much weaker hydrogen-bond linkages, which are considered as secondary valences and serve to enhance the effects of the cystine bridges and salt linkages.

At the isoelectric point (pH of about 5) the charges of the salt linkages of wool are in equilibrium. In an acid medium, the salt linkages are removed and an equilibrium is reached for any given pH value of the dyebath according to the dyeing mechanism shown in Fig 2a.

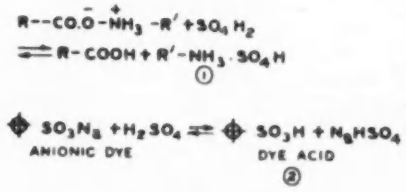



**Figure 2a**
**Dyeing Mechanism—Amino-genic Groups**

The addition of an acid, such as sulfuric acid, causes the activation of all salt linkages, and at the pH of 2 the wool actually fixes about 4% sulfuric acid. Salt linkages being removed, the wool fiber will fix the colorant, optimal pH conditions depending on the chemical nature of the dyestuff and its concentration in the dyebath. If more colorant is to be fixed, more dyeing sites must be created, and this must be done by breaking more salt linkages of the keratine.

In an acid medium, the free acid of the anionic dye is formed, and the dye anion will then displace the acid anion already fixed by the wool fiber. This displacement is possible because the combination keratin ——$SO_3H$ ($R' — NH_2 . SO_3H$ of formula) is more readily hydrolyzed than the combination of keratin and dye anion (see Fig 2b).

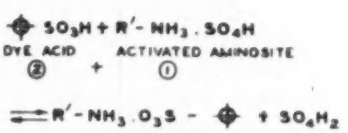



**Figure 2b**
**Dyeing Mechanism—Amino-genic Groups**

Initially this equilibrium takes place at the outer surface of the fiber. The interior mass of the fiber does not at first take part.

Substantially simultaneously, the wool fiber begins to swell with eventual rupture of part of the cystine linkages, causing the interspace between chain layers to increase in volume. This swelling action increases the contact surfaces of the fiber with the dye liquor thus bringing about a shift of the chemical equilibrium toward the end phase. In the ordinary dyeing process, both dynamic (swelling) and chemical (dyeing) equilibrium reach the end point at the boil and only after considerable time, which, under atmospheric pressure, that is to say, in open-tub dyeing, is seldom less than one hour.

In pressure dyeing, usually performed at a pH close to the isoelectric point, the rupture of the cystine bridge is effected almost exclusively under the influence of temperature increase, and at 221°F (105°C) both dynamic and chemical equilibria are reached simultaneously within a few minutes.

Prolonged boiling in both atmospheric and pressure dyeing processes will definitely cause degradation of the fiber with considerable loss in mechanical resistance. Short-cycle pressure dyeing therefore offers definite advantages, although its control must be carefully watched (static process Steverlynck).

Swelling properties, broadly speaking, are intimately connected with the moisture absorption and moisture regain properties of the fibers and are indirectly related to wettabiilty. These are the properties that distinguish hydrophilic fibers from hydrophobic fibers, the latter being noted for their low moisture absorption, low moisture-regain values and water repellency. In the case of wool, the hydrophilic properties are essentially responsible for opening the door to the aminogenic dyeing sites.

Let us turn now to the inner structures of the modern synthetic, or chemical, fibers, as they are better termed, in contrast to the natural fibers and the man-made fibers from cellulose and the natural proteins (cellulose acetates, viscose, Vicara, Ardil, etc).

From the point of view of dyeability, a strict chemical classification is necessary. Based on the foregoing remarks on the necessity of the presence of dyeing sites and, more specifically, of basic or amino sites, which are required in dyeing with acid dyes and related colorants, we must differentiate between those chemical fibers which, by virtue of their chemical composition, contain aminogenic groups and others which are devoid of them.

In the first group are included the polyamides (Nylon 6, Nylon 66, etc) and in the second group, the much broader class of truly hydrophobic fibers derived from vinyl, vinylidene and acrylonitrile polymerization (Vinyon, Dynel, Saran, Orlon, Acrilan, etc) and the polyesters essentially represented by Terylene or Dacron.

NYLON 6 OR PERLON L (CAPROLACTAM POLYMER)——Polyamides manufactured from caprolactam, the internal salt of E-amino caproic acid, were first made known commercially in Germany by the trade-mark name Perlon L. Also designated by the generic term "nylon 6,"

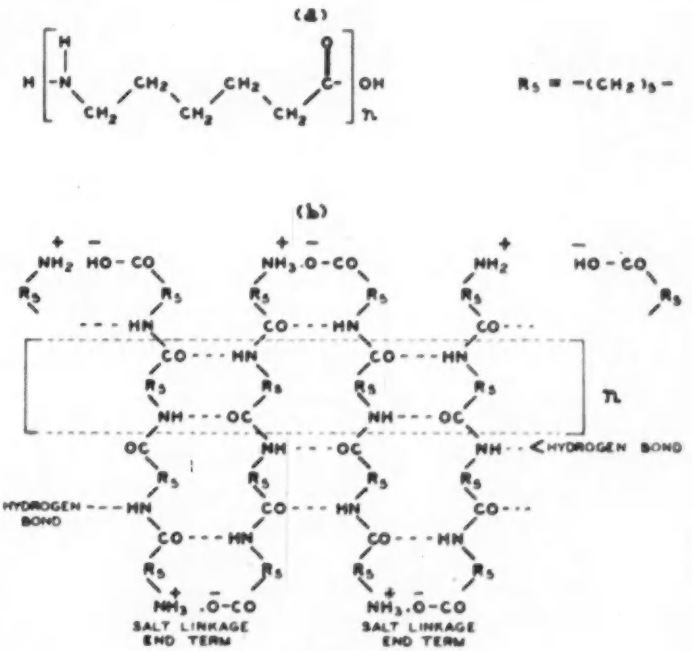



**Figure 3**
**Nylon 6**

certain concerns in the United States have indicated their interest in this type of polymer, Allied Chemical & Dye Corp having announced its intention to start production of nylon 6 this year. Its structure may be schematically represented as in Figure 3.

In many of its dyeing properties, Perlon L resembles wool and represents a happy compromise between a strictly hydrophilic fiber, such as wool, and the hydrophobic fibers of the Orlon-Dacron series. Because of a large number of amino sites and hydrogen-bond linkages, it possesses excellent dyeability, the mechanism of dye fixation being quite similar to that of wool. It is quite resistant to degradation, has low moisture adsorption as compared with wool, good elasticity, and excellent resistance to abrasion. These are but a few of the fine character references of this fiber, which has found a ready market, especially in staple form in combination with wool and other fibers, and as filament.

Cross sections of dyed staple and yarn show excellent penetration, whether dyed at atmospheric pressure or under higher temperature conditions. Dyes suitable for wool are likely to dye nylon 6, and excellent results may be obtained by using vats, soluble vats and acetate dyes. Acid dyes, and in addition, metalized acid azo dyes, are quite suitable. There is no special problem involved in the dyeing of Perlon L. In combination with wool and other fibers as a union it closely follows nylon 66, with the exception that it has better dyeability in both light and heavy shades.

NYLON 66———The molecules of nylon 66 are long and straight, in fact similar to those of nylon 6 (compare Figures 3 and 4). There are neither side chains nor cross linkages. However, depending on the degrees of polymerization and stabilization, the nylon 66 molecule may have a different number and location of amino sites. Earlier nylon brands, as we all remember, presented varying degrees of dyeability. A prerequisite for uniform, level dyeing of nylons is fiber uniformity.

In general, nylons and wool have a number of common aspects in their chemical structures. The presence of amino groups has, as shown above, an important bearing on the process of dyeing, especially in the case of level-dyeing acid dyes. Recent work has indicated that nylon possesses about one active aminogenic group for thirty such groups in the wool fiber. This indicates that the saturation value of wool for acid dyes is about thirty times that of nylon. In the dyeing of weak shades on mixed fibers of wool and nylon with level-dyeing acid dyes, the major portion of the dye is adsorbed by the nylon, which in dyebaths of low concentration has a greater affinity for such dyes than wool. If the dye concentration is increased to reach the saturation point for nylon, a good union generally results. Higher concentrations (above the saturation point) obviously will produce heavy shades on the wool fiber only. If heavy uniform shades are desired, recourse must be had to a member of the very limited group of dyes which produce a good union on both wool and nylon or to a mixture of acid dye and acetate dye.

RESISTING NYLON———Shades corresponding to dye concentrations below the saturation point are less of a problem, since there are methods by which preferential dyeing of nylon can be prevented. One such method involves use in the dyebath of colorless bodies that preferentially affix themselves to the amino groups of nylon. Products of this type may be termed colorless acid dyes devoid of chromophoric groups or may, in fact, be sulfonated derivatives of castor oil or naphthalene sulfonic acids, such as Nacconol NR, an alkylarylsulfonate, which has been found to be an excellent blocking-out agent. The weaker the shade, the more a resisting agent is required for the nylon.

HYDROGEN BONDS———Little has been said, so far, of the role played by hydrogen bonds. These constitute important parts of wool and polyamide fibers, in which these bonds serve both mechanical and physical purposes. To hydrogen bonds are attributed the properties of holding the molecules together by intermolecular forces generated by the carboxyamide group between parallel chains of the fiber structure. This network of forces has its importance in the processing and setting of chemical fibers and is instrumental in the introduction of deformation of shape as well as creases and wrinkles of semipermanent nature. In the absence of strongly hydrophilic groups, this action is mainly one of cohesive forces, with the result that swelling of the fiber becomes very small and is practically nil in fibers presenting smooth, cylindrical surfaces, as is generally the case in high-tenacity filaments. The hydrogen bonds also definitely generate attractive forces toward dyestuff molecules. Their action in this respect is at first primarily peripheral.

In wool, where this action is greatly overshadowed by a large number of hydrophilic polar groups favoring swelling and penetration of the dye liquor into the fiber interspaces, they are able, nevertheless, to affix colorants. Retention of acid dyes in particular is largely due to exist-

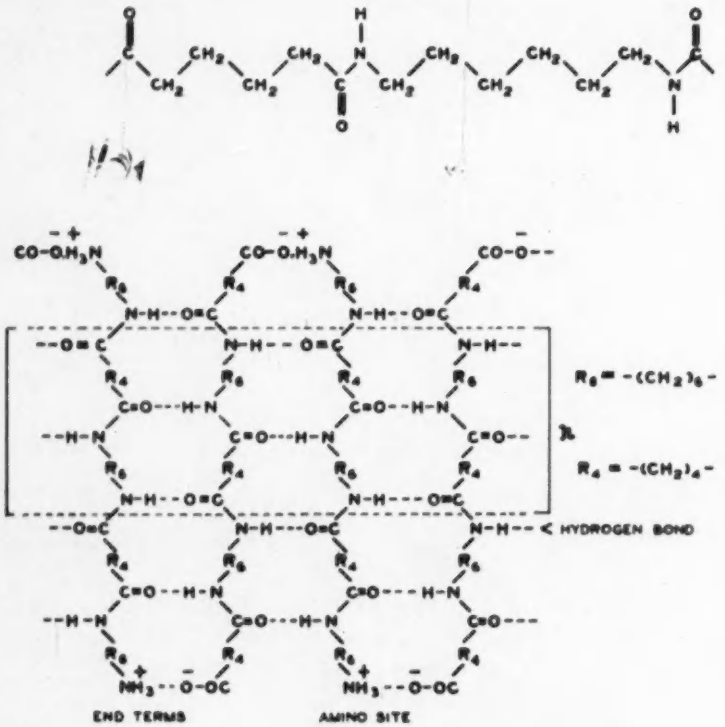



Figure 4
Nylon 66

ence of secondary valences (van der Waals forces), which come into play at lower pH's when the amide groups become basic and thus create new sites for adsorption of dye anions. This property has been used in the top shading of heavy blacks and navies on wool, although top-dyed heavy shades have been reported to be relatively fugitive. At higher pH values, and especially in neutral solutions, attraction may occur by hydrogen bonding with nonionic groups in the dye molecule, such as the amino, hydroxyl or azo groups, but with no specific evidence of actual dye adsorption.

In polyamide fibers, hydrogen bonds have a similar action on dyes. This action is initially one of attraction toward the peripheral layers. Low swelling properties considerably hinder penetration into the nylon fiber, unless the colorants themselves possess a certain degree of solubility in the polyamide.

Disperse (acetate) dyes, which are themselves hydrophobic and soluble to a variable extent in the polyamide, do not appear to offer much of a problem in dyeing, although in many cases better dyeability, especially in heavy shades, is obtained with the use of a carrier, preferably a solvent common to both fiber and dye.

Acid dyes in general have poor migrative properties, especially at temperatures below the boil. Higher temperatures will favor penetration and diffusion, but will not increase adsorption beyond the respective saturation points of the colorants at any given temperature and pH value.

The saturation points themselves are influenced to a definite extent by the degree of orientation of the fiber. The greater the orientation, the lower the saturation point. It follows that highly oriented fibers, especially high-tenacity filament yarns and fabrics, are best dyed at high temperatures or under pressure.

Depending on their chemical structures, acid dyes show great differences in their diffusion and adsorption rates and conversely in their fastness degrees. If we discount the influence of all other polar groups, we find that the number of sulfonic-acid radicals and the presence of hydrophobic chain or ring systems devoid of hydrophilic polar groups seem to be the controlling factors in dye adsorption. Acid dyes possessing hydrophobic chain or ring systems will migrate and diffuse at a higher rate, the lower their molecular weight and the lower the number of sulfo groups. At the lowest acceptable limit they produce dyeings which are nearly as well penetrated as those made with acetate dyes, and they display improved wash-fastness properties. The more valuable and larger class of multipolar, acid, fast wool dyes will in turn show slower diffusion rates but will display considerably better all-around fastness properties. Low diffusion rates are usually associated with imperfect penetration; a cross section of dyed nylon shows a colored-ring effect around a colorless, or nearly colorless, core. These dyes are commonly called "ringers". In fact, it is unusual to find a fast dye on nylon that is not a ringer.

SATURATION OF NYLON WITH ACID DYES———Under controlled dyeing conditions, especially at high temperatures with a pH range from 7 to 5.5, that is, above or slightly above the isoelectric point of wool, the nylons will fix acid dyes to a given saturation point. At pH 5 or thereabouts, most available aminogenic groups are saturated, and no further fixation will take place in spite of the presence of a multiple array of hydrogen-bond linkages. However, activation of the carboxy acid-amide groups resulting from a pH change to lower values (pH of 2-3) will again increase dye adsorption to a new saturation point and produce heavier dyeings fast to washing. This latter property goes hand in hand with the poor migrating power of acid dyes in the polyamide fiber, and is another reason why the high-pressure technique, in the presence of acid, should normally produce on nylon heavy shades that are more deeply penetrated, more uniform, and fast to washing. In practice, lid-covered tubs and jigs, permitting maintenance of temperatures close to 212°F, will produce satisfactory results.

## THE MORE HYDROPHOBIC SYNTHETICS

As we leave wool and the polyamides with their rich amino sites and turn to the chemical fibers of the second group, we really enter a sphere of pronounced "hydrophobia". It is desirable to divide these fibers further into subgroups because of the essential differences between their chemical constitutions.

These differences are primarily associated with the fact that, while nitrogen is absent from the subgroups that include Dacron, Saran and Vinyon, it appears essentially in the form of the monovalent nitrile radical in the polyacrylics, which include Orlon, Dynel, Acrilan and others.

POLYESTERS——— A comparison of the chemical structure of cellulose acetate with the structures of Vinyon, Saran and especially Dacron shows that there is similarity between their constitutions. As a class these fibers may be broadly termed "polyesters". Saran may be regarded as an ester of hydrochloric acid and polyvinyl alcohol, or as a copolymer of vinyl and vinylidene chlorides; Vinyon is a copolymer of vinylchloride and vinylacetate, while Dacron (Terylene) is the well-known polyester of terephthalic acid and ethylene glycol (see Figures 5 through 9).

It is therefore rather obvious that the polyester fibers should preferentially be dyeable with plasto-soluble dyes, such as the classical acetate colors or appropriate modifications thereof, and with other classes of colorants that have found application in the dyeing of highly acetylated celluloses, such as the color-base-naphthol combinations, and to a lesser degree with vats in the acid form and in the form of leuco vat esters.

The theory of the dyeing of polyesters is very much like that underlying the dyeing of cellulose acetate, the mechanism being one of peripheral attraction by hydrogen bonding (activated in acid medium) with ensuing penetration and diffusion by solubility.

With the disappearance of hydrophilic properties, the diffusion rates decrease considerably, and dye adsorption becomes exclusively a function of pH, temperature and swelling properties of the carriers, which become necessary for proper fixation. High-temperature processing, wet or dry (high-pressure dyeing and Thermosol process), appears therefore to be essential for good dyeability, but its application is necessarily limited to Dacron, which is dimensionally stable to the desirable higher dyeing temperature in contradistinction to Saran and Vinyon, which becomes highly thermoplastic at temperatures in the neighborhood of 230°F (110°C). Whatever condition of temperature may be used, carriers such as chlorinated benzenes, emulsifiable forms of diphenyl, para- and orthophenylphenol, benzoic acid, salicylic acid, sulfated fatty acids (Tetranol) and solvents such as phenylmethylcarbinol, methylisobutylketone and the like, which render the amorphous region accessible, have been successfully used on all three fibers at dyeing temperatures below, and up to, the boil, and on Dacron in pressure dyeing. Dacron has been successfully dyed with acetate dyes, without accelerators, at 250°F in the presence of about 2% acetic acid, 28% owf (on wt of fiber).

The inherent difficulty of the polyester fibers to swell renders the dyeing processes time-consuming, and, if good fastness properties are desired, operating cycles from two to three hours (or more, for highly oriented high-tenacity filaments) are usually required.

In view of the lower softening points of Saran and especially of Vinyon, suggested methods of "dope" dyeing these highly thermoplastic fibers offer a convenient way for producing fast shades with a larger variety of dyes. The dyeing of Vinyon HH with selected dyes, whether acid, metalized or direct, from Cellosolve solutions by immersion has produced

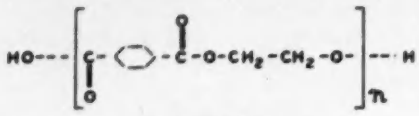


**Figure 5**
**Dacron (Terylene)**
M.W. = 15,000-20,000

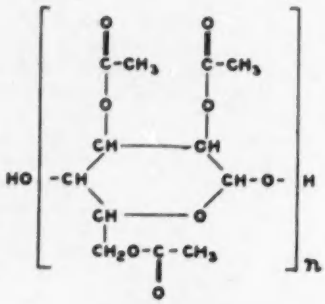


**Figure 6**
**Cellulose Acetate**
D.P. = 350-400
M.W. = 288
2.3 acetylation
M.W. = 259

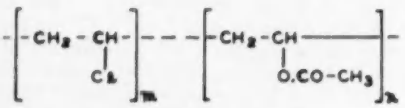


**Figure 7**
**Vinyon**
**Copolymer of Vinyl Chloride 88% and Vinyl Acetate 12%**
M.W. = 10,000-28,000
M.P. = ~150°C.
T.P.T. = ~70°C.

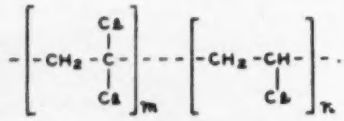


**Figure 8**
**Saran**
**Copolymer of Vinylidene Chloride and Vinyl Chloride**
M.W. = 20,000
$Cl_2$ Content = ~72%
T.P.T. = ~116°C.

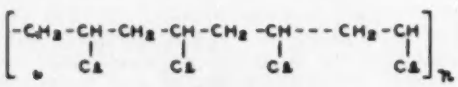


**Figure 9**
**"Pe Ce"**
**Vinylchloride Polymer (Chlorinated)**
M.W. = ~20,000
$Cl_2$ Content = 56.8-64%

excellent results in spite of the somewhat uneconomical aspect of the method.

PE CE FIBER———The German Pe Ce fiber, a chlorinated polyvinylchloride, has dyeing characteristics which closely resemble those of Saran. It has a softening point somewhat lower than that of the latter, and therefore lends itself only to atmospheric dyeing below 212°F (100°C) or to dope dyeing. To my knowledge, this fiber has not been produced commercially in the United States.

POLYETHYLENE FIBERS———Polyethylene fibers deserve special mention. They are addition polymerization products of ethylene gas under high pressure and high temperature. They are compounds which consist wholly of joined linear hydrocarbon chains, the recurring groups being the divalent ethylene group $-CH_2-CH_2-$. Their water absorbency and moisture regain are the lowest on record. They swell at room temperature in chlorinated hydrocarbons, aromatics and aliphatics and become soluble in these solvents at 160°F. They cannot be colored by normal dyeing procedures, to which the fiber is wholly immune, but they can be dyed by pigmentation of their genetic masses before these are extruded to form the fibers.

Ordinarily, acid colors as a group as well as the related premetalized dyes refuse to "take" on polyester fibers when dyed from aqueous solutions. These dyes require the presence of aminogenic dyeing sites. Moreover, it seems reasonable to expect that fibers, such as Vinyon and Saran, which contain 64 to 73% chlorine, respectively, would be highly stubborn to normal dyeing procedures. One might jokingly and truthfully say that there is no foreseeable way of dyeing chlorine.

POLYACRYLICS———Now, the problem of coloring polyacrylics, which are loaded with nitrile groups, resembles the problem of dyeing chlorine-loaded fibers, for the nitrile group, like chlorine, is not likely to be amenable to coloring. Therefore, the story of discovery of successful methods for dyeing polyacrylics is fascinating.

First attempts at dyeing polymeric fibers from 100% polyacrylonitrile were unusually discouraging. The structure of a polyacrylic fiber is essentially represented by a linear assemblage of the recurring divalent propylene nitrile group $-CH_2-CH(CN)-$ (see Figures 10 and 11).

Graphs showing the X-ray diffraction patterns of a polyacrylic show the presence of highly crystalline zones and amorphous zones embedded in the fiber molecule in variable proportions depending upon the degree of stretch and thus upon the orientation to which the polyacrylic is

subjected during drawing. Usually the only difference in the characteristics of filaments of high tenacity and those of staple fibers is the difference in orientation of the crystalline zones.

ORLON———In contrast to its fiber properties, the dyeability of the early Orlon, a polyacrylic fiber, was far from satisfactory. Plasto-soluble colorants of the acetate type yielded acceptable, though subdued, shades. Some selected basic colors produced a promising color range. In spite of the presence of nitrogen in the molecule, acid dyes could not be persuaded to color the fiber, and highly oriented filaments remained unstained, even after prolonged dyeing under pressure.

High-temperature dyeing (Thermosol process) and high-pressure dyeing in the presence of carriers such as paraphenylphenol were reported to give heavier and faster shades with acetate dyes and with basic colors and vats (the latter two without a carrier). Naphthol-color-base combinations applied at the boil were said to give excellent wet fastness but very poor light fastness.

Variations of the polyacrylonitrile fiber consisting in copolymerization products of acrylonitrile with vinyl chloride, vinylacetate, methylmethacrylate, etc, yielded similar but somewhat better results. Acid dyes still proved stubborn. Metalized dyes were not even mentioned. In short, the results all around were far from satisfactory to a highly discriminating trade.

These discouraging beginnings showed that entirely new dyeing procedures had to be evolved or the new interpolymers had to be somehow modified if these new fibers were to be dyed satisfactorily by modern colorants. Hence, when the cuprous-ion method, first described by Feild and Fremon of Carbide and Carbon, appeared on the horizon, it could not but enlist a wide interest, for at once it made a large variety of colorants usable to the dyehouse for practical and acceptable dyeing of the polyacrylics.

THE CUPROUS-ION METHOD———In contradistinction to its monomer, vinylcyanide, the glassy polyacrylonitrile fiber does not lend itself readily to modifications in situ by chemical reactions. The creation in particular of amino sites to replace or modify the nitrile group of the polymer cannot be effected without considerable difficulty, and, if effected, the modification markedly alters the physical properties of the fiber.

The nitrile groups per se are inert to dyeing with acid dyes; they do not attract dye anions like the amide groups of the nylons and wool molecules, which are activated and become weakly basic under low pH conditions. The discovery that copper in the cuprous valence state attaches itself to the nitrile radical of the polymer, thus creating a basic (metal) dyeing site, is therefore not only ingenious but quite unique (see Figures 12 and 13).

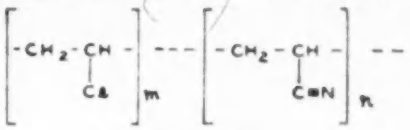


**Figure 10**
**Dynel (Vinyon N)**
**Copolymer of Vinylchloride 60% and Vinylcyanide 40%**
$Cl_2$ Content = ~30.5%
CN Content = ~22.5%

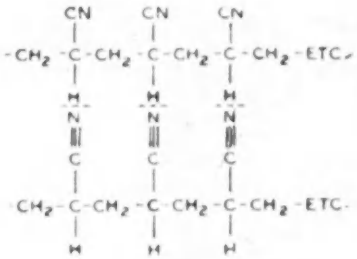


**Figure 11**
**Polyacrylonitrile (Orlon)**
N.W. = 25,000
CN Content = ~50%

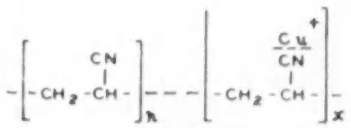


**Figure 12**
**Copperized Polyacrylonitrile**

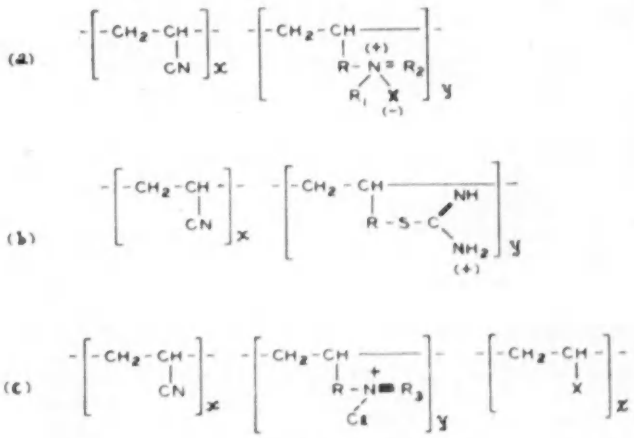


**Figure 13**
**Quaternization of Polyacrylonitrile**

Up to now no structural diagram based on convincing evidence has been presented to show the exact orientation of the cuprous ions in the polymer molecule;

however, it stands to reason that the adsorption of the cuprous ions by the acrylic fibers is an equilibrium reaction resulting in the formation of co-ordinate bonds between cuprous ions and selected nitrile groups, which are apparently arranged in a specific configuration in the molecule of the polymer. Each absorbed cuprous ion thus provides a dyeing site for each monovalent anionic dye. These dyeing sites attract any colorant possessing at least one sulfonic acid group or any other salt-forming group in its molecule.

The application of the cuprous-ion method need not be discussed further at this time since the details of the method have been described with high competence in the excellent papers by R H Blaker, who has done admirable work in this field *(2)*. I shall mention only that the copper method has made it possible to dye successfully synthetic fibers composed of 100% polyacrylonitrile as well as of the various interpolymers in full ranges of shades with acid and direct dyes, soluble leuco vat-dye esters, metalized acid azo dyes, chrome dyes and mixtures of acetate and acid dyes and other combinations in complete color ranges, yielding results often beyond expectations.

As is to be expected, the high-pressure technique does yield better results than the dyeing methods at atmospheric boil. The use of carriers in most instances may be dispensed with entirely. Highly oriented filament fibers, such as Orlon 81, still are dyed better under pressure and/or with the use of carriers.

LATEST IDEAS OF IMPROVING DYEABILITY———The art of changing the chemical nature of natural fibers provides a clue to the resolution of the problem of the dyeability of modern synthetics. The application of such an art to polyacrylics in particular opens the door to new modifications of these fibers. Such modifications promise to simplify the problem of dyeing the fibers in full and fast shades without sacrificing the advantageous physical properties that characterized the early varieties of polyacrylics.

For a while, Professor Karrer's "immune cotton", discovered in the early twenties, stimulated much interest. This immune fiber is made by condensing alkali cellulose with highly reactive aromatic nitro bodies, such as nitroparatoluenesulfonchloride. The resulting product is a nitro compound, which is immune to dyeing. However, when the nitro groups in this cellulosic compound are reduced to amino groups, they become basic sites and render the cellulosic material receptive to acid dyes. This process was called "animalization" of cotton, because the modified form of the cotton acquired some of the acid-dyeing properties of wool and silk. If the process was short-lived because of the high depolymerization of the cellulose, it at least opened the door to similar reasoning in the conversion of synthetic polymers devoid of quaternary nitrogen or aminogenic dyeing sites into amidated derivatives, which display properties in dyeing closely resembling those of silk, wool and the nylons. Since the physical and chemical properties of the polyacrylonitrile fibers had to be preserved, and reactions similar to Karrer's condensation could not be performed without serious impairment of the physical characteristics of the fiber, a roundabout way had to be found to achieve what we may term even now "animalization".

This is done in two days: first, acrylonitrile and basic reacting monomers are copolymerized to yield fiber polymers possessing greater affinity for acid dyes. Secondly, acrylonitrile is copolymerized with monomers which are themselves susceptible of conversion into aminopolymers, thus providing the resulting copolymerization product with the necessary aminogenic and quaternary amino dyeing sites. The chemistry of this type of copolymerization is quite fascinating and needs much more time than we can spare tonight to be dealt with adequately. It is sufficient to say that the principle is widely applicable for the production of polymeric fibers. Many patents show this, and recent ones indicate that polyesters also may soon become dyeable with acid dyes by a similar procedure.

It was found that in such copolymerizations the amount of aminopolymer need not be large, thus preserving, essentially, the characteristics of the polyacrylonitrile fiber base, yet providing a sufficient number of amino sites to satisfy dye saturation and to yield commercially acceptable shades.

Further advances have been realized in the discovery that the introduction of quaternary amino sites into tailor-made acrylocopolymers can also be effected in the dye bath. Alternate methods like these, however, entail additional controls and therefore appear to offer little advance over the present cuprous-ion method. The latter is well established, universal in its application to all polyacrylics and is a reliable standby for use when unexpected deficiencies occur in dyeing acrylic fibers.

The road to success in the accomplishment of these objectives is long and arduous. The results achieved to date are a great tribute to the skills of the chemists and colorists who have fathered and promoted these ideas. They merit high admiration.

The newer acrylics, such as Orlon 42, Acrilan, Dynel, and others, are the definite signposts of this progress and the prologue to tomorrow's "Miracle Fiber".

## REFERENCES


*(1)* Wilson, A M, "Whither Man-Made Fibers", *J Textile Inst* 44, No. 4 (April, 1953).
*(2)* Blaker, R H, *Am Dyestuff Reptr* 42, P76 (1953).


## Colorimetry——

*(Concluded from page P21)*

bond's 70-year-old invention is playing a most interesting part in atomic research in connection with skin-pigmentation changes due to radiation burns. Manufacturers of television screens in a number of countries are adjusting the fluorescent color of their phosphors with the help of the Tintometer, and in at least one country our equipment is contributing to the improvement of color-television technique. In several countries the railroad- and airport-signalling-equipment makers and users have found that tolerances in the color of signal lights, although expressed in highly mathematical form, are more easily understood by visual comparison against our glass standards, and the fluorescent colors of indicator dials in the cockpits of night-flying planes are standardized in the same way.

Birdwatchers are recording the exact colors of plumage of birds and then freeing them, instead of killing and preserving them. The health of agricultural workers is being guarded by the application of Lovibond color tests to blood when poisoning from the use of chemical sprays is suspected.

Perhaps the most interesting enquiry of recent times was from behind the Iron Curtain for an instrument to measure the redness of paper.

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*(1)* Judd, D B, "Color in Business, Science and Industry", John Wiley & Sons, N Y (1952).
*(2)* Wright, W D, "The Measurement of Color", Adam Hilger Ltd, London (1944).
*(3)* Chamberlin, G J, "The CIE International Color System Explained", Tintometer Ltd, Salisbury, England (1951).

*Piedmont Section——*

# A STUDY OF THE DYEING OF DACRON FABRICS BY THE CARRIER METHOD*

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**An experimental laboratory study of seven carriers for the application of disperse (acetate) dyes on Dacron polyester fiber has shown that one carrier or one combination of two carriers of those tried does not always give the best results. Fifteen per cent of betanaphthol, 20% of benzoic acid, 15% of benzyl alcohol, or a combination of 5% of benzoic acid and 10% of betanaphthol owf gave the best sorption of disperse dye according to the particular dye employed in the experiment. The use of betanaphthol alone and the use of acetophenone to increase the effectiveness of Dowicide A and betanaphthol as carriers are the two most interesting conclusions of the work.**

## INTRODUCTION

DYEING ASSISTANTS FOR DACRON——"It is now well established that, although Dacron† polyester fiber intrinsically has high affinity for disperse and azoic dyestuffs, the rate of diffusion of these dyestuffs into the fiber is extremely slow. This makes the production of shades of medium and heavy depths virtually impossible under normal conditions of time and temperature. Two methods of increasing the rate of diffusion are known, and, of these, the use of so-called 'carriers' or 'swelling agents' has been investigated. The mode of action of these substances is not entirely clear, but, at least, some opening up of the fiber structure takes place, which increases the rate of diffusion of the dyestuffs into the fiber and this in turn facilitates the production of shades of heavy depth." This method of dyeing Dacron fiber is particularly attractive, since it does not involve any modification of the existing dyeing machinery. In comparison, the other method of increasing the rate of diffusion of dyestuffs into the fiber involves the use of high temperature for dyeing, either under pressure or by a dry-heat dyeing technique. In this case, specialized equipment becomes necessary. This paper is concerned only with the "carrier" or "swelling-agent" method.

With the help of certain individuals and material on the subject an attempt to find the most suitable assistants and methods of utilizing these assistants to acquire the desired effects on Dacron was begun.

## EXPERIMENTAL

PROCEDURE —— The following general procedure was used in all the laboratory work on this problem: Enter the Dacron skein into a boiling, forty-to-one, dyebath solution containing two percent dyestuff and varying percentages of the assistants in question ranging in intervals of five from zero to fifteen percent on wt of fiber (owf). Dye at this temperature sixty minutes, rinse. Soap in a two-percent soap solution if the assistant might reduce the fastness to light or tender the fiber, rinse, cool, and dry.

The following assistants were used:

Dowicide A (sodium orthophenylphenate)
paraphenylmethylcarbinol
paraphenylphenol
salicylic acid
benzyl alcohol
benzoic acid
betanaphthol

The following dyestuffs were used:

Disperse Black SN
Disperse Fast Blue GLF
Disperse Blue BNN
Disperse Fast Violet RLF
Disperse Fast Violet GLF
Disperse Yellow 5G
Disperse Orange 2R
Disperse Rubine C
Disperse Red GLF
Disperse Red B

RESULTS——In summing up the results of this part of this research, the following facts seem important:

An indication of varying degrees of improvement was realized in dyeing with each of the assistants.

In every case, under the same condition, the exhaustion of the dye was more complete with an assistant than without.

With the Disperse Blue BNN five percent benzoic acid plus ten percent betanaphthol as the carrier seemed to give the best depth. From this indication it can be drawn that two or more carriers in the same dyebath will cause better dye exhaustion with some disperse colors than one carrier alone.

Fifteen percent betanaphthol gave the best depth of shade of all the assistants listed above with Disperse Rubine C and Disperse Orange 2R, while twenty percent benzoic acid gave better dye adsorption with Disperse Fast Violet RLF.

Table I gives more information concerning the different dyes.

Although our tests indicated that several carriers were more effective for dyeing Dacron than the phenylphenol types, when the cost and toxicity of these carriers were considered, it was decided to base the remainder of our work on the phenylphenol type. We therefore hoped to find improvement in results by variations of application procedure rather than by the possible use of an impractical carrier.

The remainder of our work consisted of comparing a formula now in use for Dacron fabrics with variations of details.

This practical formula was as follows:

*Dyeing*
Add: 2.7% acetic acid (80%).
Add: Necessary dye at temperature of 120°F. Raise the temperature to the boil in one hour and then boil for forty-five minutes.
Add: 1.4% acetic acid (80%) over a period of 15 minutes. Run for 10 minutes.
Add: 18% Dowicide A
Boil for one and one-half hours. Rinse.
*After Scour*
Add: 3% hydrosulfite.
Add: 3% caustic soda.
Scour for 20 minutes at 160°F. Rinse.

MODIFICATIONS —— Several preliminary modifications of this practical procedure were tried, and the most promising results were indicated by the pro-

* Presented by Z L Collins at Roanoke, Virginia, on April 10, 1954, as one of two entries in the 1954 Student Contest of the Piedmont Section. This paper was awarded second place in the Contest.

† Trade-mark of E I du Pont de Nemours & Co, Inc.

**TABLE I**

**RELATIVE EFFECTIVENESS OF CARRIERS FOR VARIOUS DISPERSE DYES**

| *Dye Disperse* | *Rank* | *% owf* | *Carrier or Carrier Combination* |
|---|---|---|---|
| Black SN* | 1 (best) | 15 | betanaphthol |
| | 2 | 10 | betanaphthol and |
| | | 5 | benzoic acid |
| | 3 | 5 | betanaphthol and |
| | | 10 | benzoic acid |
| Fast Blue GLF | 1 | 15 | benzyl alcohol |
| | 2 | 10 | benzyl alcohol and |
| | | 5 | betanaphthol |
| | | | (more naphthol causes dullness) |
| Blue BNN | 1 | 10 | betanaphthol and |
| | | 5 | benzoic acid |
| | 2 | 15 | betanaphthol |
| | 3 | 15 | benzoic acid |
| Fast Violet RLF | 1 | 20 | benzoic acid |
| | 2 | 15 | benzoic acid |
| | 3 | 10 | benzoic acid and |
| | | 5 | betanaphthol |
| | | | (more naphthol causes dullness) |
| Fast Violet GLF | 1 | 15 | benzoic acid (very good) |
| | 2 | 10 | benzoic acid and |
| | | 5 | Dowicide A |
| | 3 | 5 | benzoic acid and |
| | | 10 | Dowicide A |
| Yellow 5G | 1 | 15 | betanaphthol |
| | 2 | 15 | benzoic acid |
| | 3 | 10 | betanaphthol and |
| | | 5 | benzoic acid |
| Orange 2R | 1 | 15 | betanaphthol |
| | 2 | 10 | betanaphthol and |
| | | 5 | benzoic acid |
| | 3 | 5 | betanaphthol and |
| | | 10 | benzoic acid |
| Rubine C | 1 | 15 | betanaphthol |
| | 2 | 10 | betanaphthol and |
| | | 5 | benzoic acid |
| | 3 | 10 | benzoic acid and |
| | | 5 | betanaphthol |
| Red B | 1 | 15 | betanaphthol |
| | 2 | 10 | betanaphthol and |
| | | 5 | benzoic acid |
| | 3 | 5 | betanaphthol and |
| | | 10 | benzoic acid |

* The Disperse Black SN did not develop completely, but the rank shown gives the relative takeup of the dye, ie, staining of the fiber.

cedure of prepadding the fabrics with the dispersed acetate dyes, and then boiling them in the dyebath with Dowicide as the swelling agent.

This procedure was therefore followed up in detail on a group of disperse (acetate) colors especially recommended for use on Dacron. This method was as follows:

Pad the goods with a sufficient concentration of dye to give a dye pickup of approximately 2% owf. Enter the padded goods, either wet or dry, into a hot bath containing:

| *% owf* | |
|---|---|
| 2 | disperse dye |
| 15 | Dowicide |
| 2 | acetophenone |

and sufficient acetic acid to bring the bath to a pH of 5. Boil the goods in this bath for 1 hour, being sure that the solution is always on the acid side. After rinsing, the goods are treated in hydro and caustic as in the practical method.

For comparison, another set of the same dyes was applied on the fabrics without the prepadding steps but with the use of the same swelling bath, but with 4% of the disperse color in each case. This 4% was equivalent to the sum of amount padded on and the 2% color added to the dyebath in the prepadding method.

SUMMARY ——— Completion of the three processes on the list of selected dyes showed that the prepadding method gave the best results in the following respects —with minor variations from dye to dye:

1) The depth of shade was as deep as or deeper than the long practical procedure.

2) The penetration and coverage of the goods was much better than that of the unpadded goods dyed for 1 hour, and equal to that of the goods dyed by the practical method.

3) The time required in the boiling dyebath was only 1 hour as compared with 3 hours and 40 minutes boiling in the practical formula.

4) Blends of wool and Dacron were covered to approximately the same depths by the short methods, and the Dacron appeared deeper by the long method.

## CONCLUSIONS

From the two parts of this work, we feel that some information on the subject of swelling agents and especially the possibility of shortening the dyeing time has been furnished as a basis for practical work.

In regard to the swelling agents, the following points seem worthwhile:

1) Beta naphthol is a cheap, useful and effective swelling agent, but somewhat difficult to remove the fabrics after dyeing. Its toxicity may not be too objectionable if used in closed, well ventilated machines.

2) All disperse dyes do not give their maximum yield with the same swelling agent or combination of swelling agents.

3) Acetophenone, although expensive, appears effective in conjunction with Dowicide A and beta naphthol in increasing penetration.

In regard to the modification of the dyeing procedure, the prepadding method appears to offer a lead in shortening the dyeing time, while giving good penetration without reduction of color fastness.

## OLNEY MEDAL AWARD of 1955

THE Committee of Award will appreciate suggestions regarding candidates for the Olney Medal Award of 1955. These should be in the hands of H C Chapin, AATCC Secretary, not later than March 1, 1955. Data on the accomplishments of candidates should be specific in such matters as journal references or patents, but all definite information will be helpful. Letters from several sponsors of one candidate are needless, except for giving additional data.

Under the rules the basis of award is outstanding achievement in the field of textile chemistry, which is understood to include the development of chemical agents or chemical processes used in the manufacture of textiles or methods of evaluation.

In making awards, the Committee need not be confined to the consideration of any one specific achievement or contribution, but may in its discretion consider the sum total of various and continued contributions to the field, no matter of how long duration.

The citation of the award, drawn by the Committee and accompanying the presentation of the medal, shall set forth clearly the occasion for the award.

The voting members of the Committee are Harley Y Jennings, Chairman, Walter M Scott, Percival Theel, President Raymond W Jacoby, ex officio, and one other to be elected.

# • PATENT DIGEST •

PAUL WENGRAF

## DYEING POLYACRYLONITRILE FIBERS Prepared in Gel State with Formaldehyde Resins C, 4, 07

U S Pat 2,686,156 (Du Pont—McClellan—Aug 10, 1954)

The preamble to this patent points out known difficulties in the dyeing of polyacrylonitrile fibers. Reference is made to U S Pat 2,491,471 (Du Pont-Arnold/1949), which calls for the addition of small amounts of vinyl pyridine to the spinning mass. These products, however, are said to lack the heat and light resistance of the nonblended acrylonitrile polymers. In several other patent applications the inventor suggests dyeing the fibers in the gel state prior to their isolation, but the limited applicability of these methods is evident.

The current invention calls for treating the polyacrylonitrile filaments, when still in the gel state, with formaldehyde resin solutions. Summarized as "formaldehyde-active hydrogen compounds", these consist of formaldehyde condensates with phenols, amines and amides (particularly urea) known in the art. According to the cited examples, aminoplast condensates are modified with alkylene diamine, e g, hexamethylene diamine. The resin-treated yarn, after drying and curing, exhibits excellent receptivity for acid, acetate, direct and vat dyes (col 3, lines 62-63 of the specification).

*Example:* a concentrated resin solution of urea in 65% methylolurea is mixed at low temperature with hexamethylene diamine and a dilute solution of p-toluene sulfonic acid. After the solution is cleared by heating and cooling down again, it is added to a cooled polyacrylonitrile solution, which is obtained by treating the solid polymer with a solution of sodium thiocyanate in 10% methanol. A viscous mass results which is extruded into water to form filaments. These have to be dried and baked at elevated temperatures so as to cure the resin components.

*Among the references cited by the Patent Office:*

U S Pat 2,556,885 (Du Pont/1951): polyvinylchloride coating compositions anchored to a substratum by a film layer, comprising a butadiene-acrylonitrile copolymer mixed with a phenol-formaldehyde condensate.

U S Pat 2,534,717 (Am Cyanamid/1950): a coating composition containing a liquid film-forming base and a finely divided acrylonitrile polymer different from this base and insoluble therein.

U S Pat 2,491,454 (Am Cyanamid/1949): slipproofing and stabilizing nylon by impregnation with noncured alkylated methylolmelamines, followed by curing [cf *Am Dyestuff Reptr* 39, 202 (1950)].

U S Pat 2,463,032 (Bakelite Corp/1949): urea or melamine resins plasticized with a homopolymerized acrylonitrile at a ratio of 10-75 p pro 100 p resin.

U S Pat 2,191,581 (Gen Electric/1940): insulating composition consisting of a mixture of acrylic ester, polymeric acrylonitrile and heat-hardenable synthetic resins.

## VAT DYEING (OR PRINTING) CELLULOSE ACETATE——

### Alkanolamines as Basic Components C, 4, 07

U S Pat 2,686,707 (Brit Celanese Ltd—Olpin, Jackson—Aug 17, 1954)

It is current practice to dye and especially to print with vat dyes by using sulfoxylateformaldehyde-potassium carbonate as reducing ingredients, and transforming the vat dye to the leuco vat by steaming, followed by reoxidation on the fibers. This method is known to give good results on cellulosic fibers but not on cellulose acetate fabrics. Unless the reaction goes so far as to effect substantial saponification very poor prints or dyeings are obtained.

It has been observed that satisfactory dyeings and prints can be produced by impregnating or printing with a nonreduced vat dye mixed with sulfoxylateformaldehyde, a thiocyanate, and a hydroxy alkylamine, such as one of the ethanolamines, hydroxyethyldiethylamine, etc. Monoethanolamine has proved to be of particular advantage. 5-25% alkanolamine by weight of the dye composition is employed; indigoid dyes require 5-15%, anthraquinoid dyes up to 25%. For economic reasons it may be advisable to replace the alkanolamines partly (down to a minimum of 4-5%) by sodium carbonate. The fabric is dried after padding (or printing), aged in substantially air-free steam for 30-50 min at 104° C, reoxidized by perborate and the like, soaped, rinsed and dried as usual.

The thiocyanate (preferable K or Na) apparently acts as a swelling agent, as in other Celanese-dyeing methods.

*Example:* a padding liquor comprising 10% of Durindone Blue 4BCS paste (Imp Chem Ind : tetrabromo indigo), 8% of sulfoxylateformaldehyde, 4% of sodium carbonate, 5% of monoethanolamine, 10% of sodium thiocyanate, 3% of glycerine, 15% of tragacanth mucilage (6%), and 41% of water is padded on a cellulose acetate fabric with a pick-up of 80%, after which it is dried, steamed twice for 15 minutes at 104-105° C, reoxidized and processed as above. The fabric dyes a royal blue shade. Analogous printing formulas are presented in several examples and some dyestuffs particularly suitable for this process are recommended.

*Among the references cited by the Patent Office:*

U S Pat 2,574,806 (Sandoz/1951) [parallel Brit Pat 661,800, cf *Am Dyestuff Reptr 43,* 305 (1954)]: printing on cellulose acetate with pastes containing in addition to the (non-acetate) dyestuff and the thickener a thiocyanate, a lower aliphatic carboxylic acid, a swelling agent (urea) and a glycol. Fixing is accomplished by simple heat treatment.

U S Pat 2,528,614 (Celanese Corp of Am/1950): vat-dyeing cellulose acetate by padding with a suspension of the nonreduced dye, drying, padding with a solution of sulfoxylateformaldehyde, plus diethanolamine, aging and finishing as usual.

U S Pat 2,524,072 (Celanese Corp of Am/1950): vat-dyeing cellulose acetate with an aqueous solution of the leuco vat containing a water-miscible organic base (such as pyridine), and optionally using diacetone alcohol as a swelling agent, omitting steam development [cf *Am Dyestuff Reptr 40,* 148 (1951)].

Brit P 622,676 (T E Marchington & Co): vat-dyeing cellulose acetate by using sodium hydrosulfite and an alkali weaker than caustic (e g, ammonia, sodium carbonate or sodium bicarbonate, also partly, alkanolamines) as vatting agents in combination with organic swelling substances, such as alcohols or the like.

Brit P 479,867 (Dreyfus-Moncrieff/1938): vat-dyeing acetate of cellulose in package form with reduced dye liquids containing mixtures of alkalihydrosulfite with ammonia or organic bases and isopropanol or other water-soluble, nonalkaline liquids.

## DYEING DACRON WITH ACETATE OR VAT DYES——

### Using Emulsions of Specific Carriers C, 4, 07

U S Pat 2,670,263 (Gen Dyestuff Co—Luttringhaus, Arcus—Feb 23, 1954)

The dyeing of polyethylene terephthalate fibers (Fiber V, Dacron) has been carried out with vat-dye pigments at high temperatures (350° F). Another known method employs the use of acetate dyes in the presence of salicylic or benzoic acids as a carrier.

The present method is intended to dye the above-mentioned fibers in deep, fast shades with both groups of these dye-

stuffs by using an improved dyebath composition consisting of the dye and a water-insoluble carrier emulsified with an appropriate agent. It is essential, however, that the emulsions have a *limited heat stability;* if the affinity of the carrier to the emulsifier is greater than that of the carrier to the fiber the results become unsatisfactory.

The carriers to be used are: xylene; naphthalene; monochloro-, o-dichloro- or trichlorobenzene.

Emulsifying agents for these carriers are: sulfonated castor oil (in most of the examples), triethanolamine stearate, alkyl- or aromatic sulfonates or polyalkylethers of alkylphenols (Igepal type). Dyeings carried out by this method reportedly show deeper and brighter shades. It is emphasized that even a black dyeing could be produced on terephthalate fibers (example 5) from 10% of a navy acetate dye and 2% of an orange acetate dye. Furthermore, better penetration, better crocking fastness and other superior qualities could be noted.

An advantage in applying acetate dyes on wool-Dacron blends is the fact that the dyes have almost no affinity for the wool portion under these conditions, thus facilitating cross dyeing with standard wool dyes.

According to the current method, optimum exhaustion can be achieved by using the vat dyes in the form of the acid leuco; normal alkaline vats do not give sufficiently deep shades. Surprisingly, the acidified leuco vats, known for their reduced water solubility, have a *greater solubility* in the *emulsified* carrier than in water. Under these conditions the dyestuff penetrates well to the center of the fiber.

Examples refer to dyeing a) with acetate dyes and b) with vat dyes.

a) A knitted Dacron fabric is immersed at 90° F into water in which monochlorobenzene is dispersed with sulfonated castor oil. After 15 minutes the blue acetate dye, tetraamino anthraquinone, is added and the temperature is initially raised to 180-190° F, and then after 30 minutes, to 205° F. It is kept for another 20 minutes at this temperature. The strong deep blue shade obtained is superior to a dyeing where benzoic acid is used as a carrier.

b) Dacron in top form is treated in a bath containing a mixture of equal parts of xylene and naphthalene, emulsified with a polyalkylether of an alkylphenol. This bath is acidified and an alkaline vat of Helindon Red BBD (Thioindigored *C I* 1207) is added, the liquid being in acid state throughout. After the temperature is raised initially to 160° F, (30 minutes), and then to 200° F (20 minutes), and reoxidizing is accomplished with sodium nitrite and acid, a brilliant red shade results.

*References cited by the Patent Office:* U S Pat 1,900,172 (Celanese Corp of Am/1933) refers to the vat dyeing of cellulose acetate. By the addition of the alkaline vat solution to an acidified dyebath the dyeing is effected with the acid leuco vat preparation.

Brit P 609,944 and 609,943 (Imperial Chemical Industries/1948): printing or dyeing polyethylene terephthalate fibers with dispersed azodyes in the presence of a swelling agent, or optionally, with mixture of bases and coupling agents in dispersed state, diazotized in a second step.

*Am Dyestuff Reptr* of Nov 13, 1950 (p 790): an abstract from Skinner's Silk & Rayon Record reports on dyeing properties of "Terylene" fibers, mentioning particularly the use of beta-naphthol and other aromatic swelling agents. It is stated that the leuco vat dyestuff esters (Indigosols) can be applied——in contrast to acid or direct dyes——about the same way as on other fibers.

## DYEING DACRON——— Nonreduced Vat Dyes Applied Under Pressure C, 4, 07

Brit P 700,171 (Imperial Chemical Industries—Hardwick et al—Nov 25, 1953)

The present method of dyeing vat dyes on polyethylene-terephthalate (Dacron) fibers differs from standard vat dyeing processes in that the vat pigment incorporated in nonreduced state in the fibers does *not have to be aftertreated with a reducing agent.* The pigment is brought into a finely subdivided state either by precipitating or by milling the aqueous paste, preferably in the presence of a dispersing agent.

The preamble to this specification mentions Brit P 609,943 (see reference in the preceding abstract), which advocates an analogous process for dyeing Dacron with disperse (acetate) dyes from aqueous media. Brit P 659,667 [Stevenson Dyers, cf *Am Dyestuff Reptr 41,* 118 (1952)] suggests that the impregnated fibers be subjected to a heat aftertreatment under pressure.

Indigoid, thioindigoid and anthraquinoid vat dyes can be employed in this method. Surface-active agents might be added as well as swelling agents to serve as carriers for the dye pigments. Especially good fastness effects have been observed in dyeing cold-drawn fibers.

*Example:* Dacron yarn is immersed in an aqueous suspension of Çaledon Red Violet 2RN (*C I* 1161) containing a condensate of alkylphenol with ethylene oxide. The dye vessel is placed in a pressure vessel and the bath is heated to 162° C by introducing steam of 80 psi. After 1.5 hours dyeing, rinsing and soaping a medium red violet shade results. Substantially no uptake of the dyestuff can be observed when dyeing is effected at 100° C.

# GENERAL CALENDAR

**AMERICAN SOCIETY FOR TESTING MATERIALS**

1955 Committee Week—Jan 31-Feb 4, Netherland Plaza Hotel, Cincinnati, O

1955 Annual Meeting—June 26-July 1, Chalfonte-Haddon Hall, Atlantic City, N J.

**AMERICAN SOCIETY FOR QUALITY CONTROL**

Annual meeting, Textile Div—Jan 27-29, Clemson College School of Textiles, Clemson, S C.

**CANADIAN ASSOCIATION OF TEXTILE COLOURISTS & CHEMISTS** (Quebec Section)

Symposia: Jan 14, Feb 11, Mar 18, Apr 15 (Ciba Company's Conference Room, Montreal, Que).

Regular Meetings: Jan 15, Feb 19, Mar 19 (McGill University, Montreal, Que).

Other events: (all at the Sheraton-Mount Royal Hotel, Montreal): Apr 21-23 (Textile Exhibition); Apr 22 (19th Annual Meeting); Apr 23 (19th Annual Dinner); June 18 (Annual Golf Tournament).

**DELTA KAPPA PHI FRATERNITY**

1955 Annual Convention—April 29-30, Lowell, Mass.

**DEUTSCHE GESELLSCHAFT FUR CHEMISCHES APPARATEWESEN**

Achema XI—May 14-22, Frankfurt am Main, Germany.

**DRYSALTERS CLUB OF NEW ENGLAND**

Jan 24, April 29 (Hotel Vendome, Boston, Mass); June 24 (Outing—Wachusett Country Club, W Boylston, Mass).

**THE FIBER SOCIETY**

Spring Meeting—May 4-5, 1955, Alabama Polytechnic Institute, Auburn, Alabama.

Fall Meeting—Sept 8-9, 1955, Massachusetts Institute of Technology, Cambridge, Mass.

**INSTITUTE OF POLYMER RESEARCH**

Symposium: Jan 8, Feb 4, Mar 5, Apr 2 (Polytechnic Institute of Brooklyn, Brooklyn, N Y).

**INTERNATIONAL TEXTILE EXHIBITION**

2nd Exhibition—June 25-July 10, 1955, Brussels, Belgium.

**INTERNATIONAL WOOL TEXTILE RESEARCH CONFERENCE**

September, 1955—Sydney, Melbourne, and Geelong, Australia.

**NATIONAL ASSOCIATION OF HOSIERY MANUFACTURERS, KNITTED OUTERWEAR ASSOCIATION, THE UNDERWEAR INSTITUTE**

42nd Knitting Arts Exhibition—April 25-29, Convention Hall, Atlantic City, N J.

**NATIONAL COTTON COUNCIL OF AMERICA**

Annual Meeting—Jan 31-Feb 1, Hotel Shamrock, Houston, Tex.

Cotton Research Clinic—Feb 16-18, Pinehurst N C.

1955 Chemical Finishing Conference—Sept 20-21, Chalfonte-Haddon Hall, Atlantic City, N J.

**NEW YORK PIGMENT CLUB**

Jan 15.

**PHI PSI FRATERNITY**

Annual Meeting—April 14-16, Beaconsfield Hotel, Brookline, Mass.

**SOUTHERN MUNICIPAL AND INDUSTRIAL WASTE CONFERENCE**

4th Annual Conference—Mar 31-Apr 1, College of Engineering, Duke University, Durham, N C.

**TAPPI** (Metropolitan District)

Jan 11, Mar 8, Apr 12, May 10 (Fraunces Tavern, New York).

**TEXTILE RESEARCH INSTITUTE**

25th Annual Meeting—March 10-11, Hotel Commodore, New York, N Y.

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WANTED: DYER-CHEMIST, with technical background, experienced in dyeing fine wools, raw stock and skeins. Excellent opportunity with future. Age 30-45. Must be willing to relocate. State experience fully in letter. All replies held confidential. Write Box No. 811.

DYER WANTED: For plant in Latin America, prefer Textile school graduate or chemist having some plant experience in dyeing synthetics or dye application laboratory experience. Give full particulars in letter. Write Box No. 817.

DYER: Chemical training. Experienced in both jig and box on the newer synthetics as well as viscose and acetate. Capable. Write Box No. 809.

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POSITION WANTED: Textile graduate with diversified background in manufacture, testing, and administration. Seeks challenging position; technical sales or service. Presently employed but desirous of more lucrative position. Write Box No. 820.

POSITION WANTED: Textile chemist, age 34, married, veteran. 14 years' diversified laboratory experience, analytical, control, research, finishing plant, dyehouse, shade matching cotton, wool, synthetics, stock, yarn, piece goods. Competitive evaluation dyestuffs and chemicals, administrative, clerical, typing experience. Rhode Island or near vicinity. Write Box No. 821.

POSITION WANTED: Over 24 years in dyestuffs manufacturing as director of application laboratory, textile chemist and colorist. Expert on all classes of dyes on all fibers. Plant trouble-shooter. Considerable office and administrative experience. Desires responsible position. Write Box No. 822.

POSITION WANTED: Textile chemist, age 31, experienced dyeing and finishing plant and development of textile chemicals. Desires opportunity in sales or development work. Write Box No. 823.

POSITION WANTED BY CUSTOMER SERVICE ENGINEER. Six years as wet processing specialist with Celanese and Burlington. An interview will be appreciated. Please write or phone: Mel Alpert, 752 West End Avenue, New York 25, N. Y., RIverside 9-3500.

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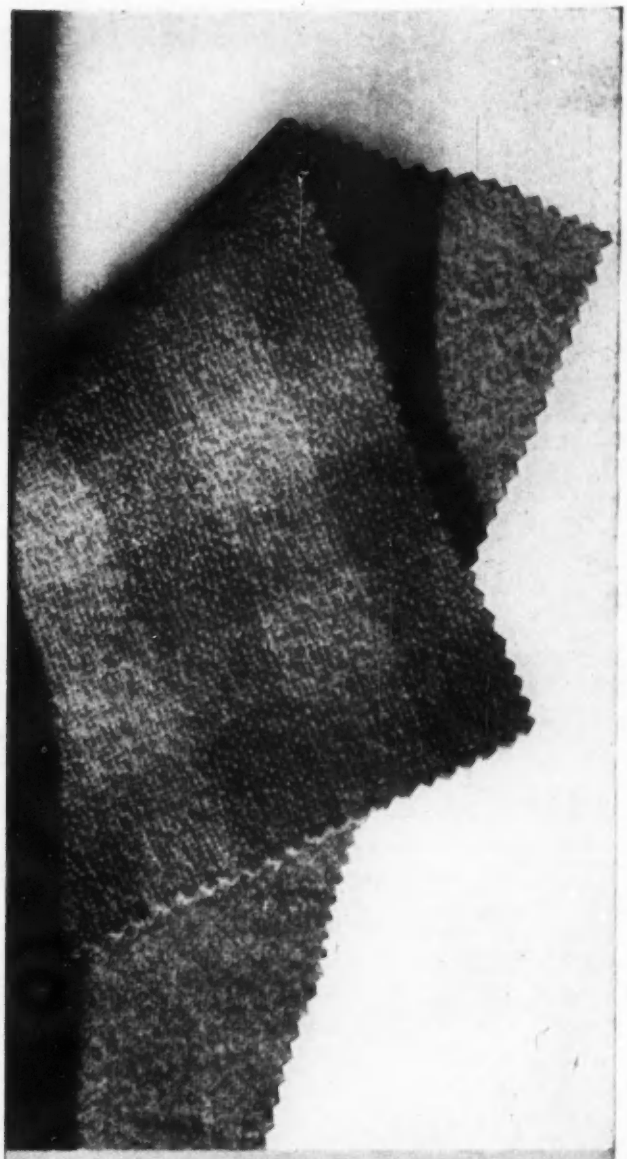

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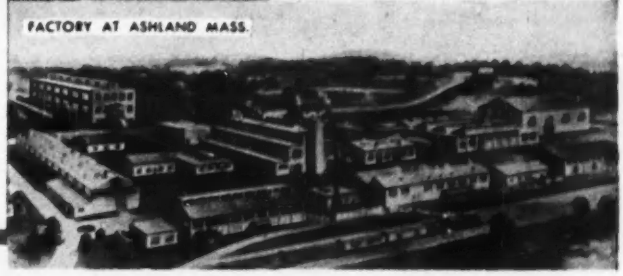

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